JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second-class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the Act of Congress March 3, 1879

VOL. XXIII No. 3 | SAN FRANCISCO, JULY 17, 1909 | PER COPY, 10 CENTS

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JOURNAL OF ELECTRICITY
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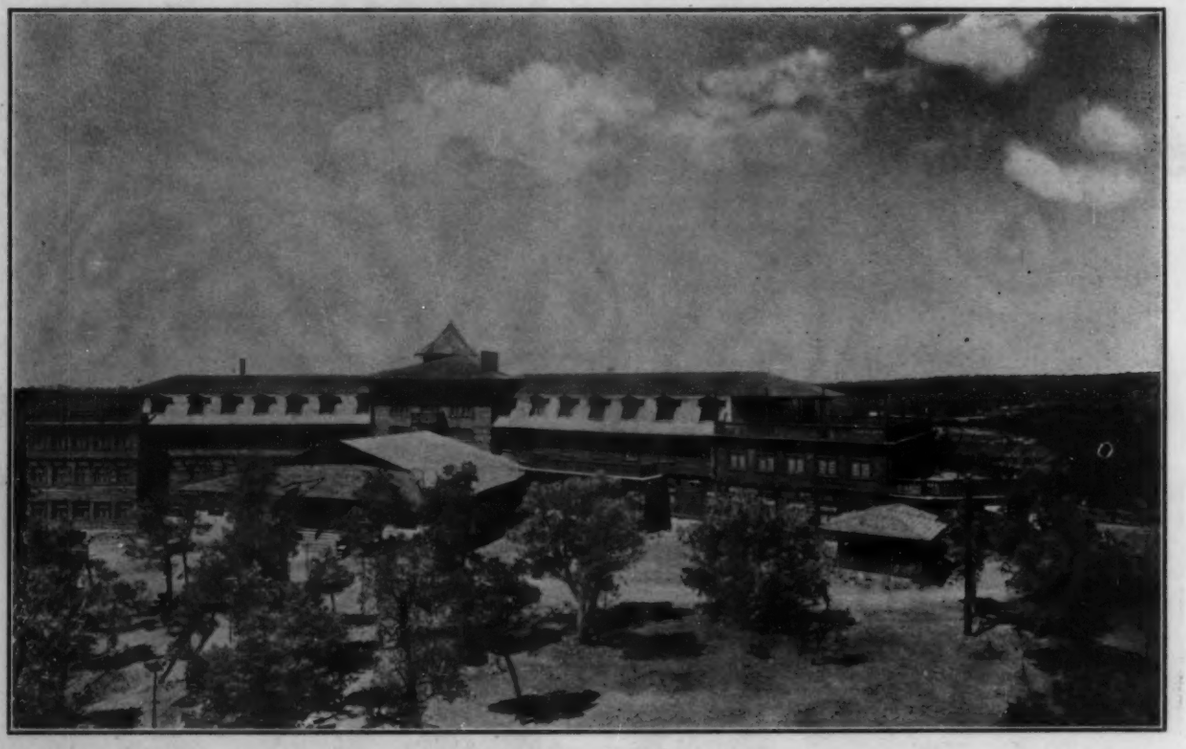
VOLUME XXIII. SAN FRANCISCO, JULY 17, 1909 NUMBER 3

POWER PLANT OF EL TOVAR HOTEL

BY R. L. WATTS.

No one can adequately describe the Grand Canyon of Arizona. It must be seen—not once, but many times. Only by frequent visits may a small portion of its ineffable loveliness be apprehended. For a distance of 500 miles the Colorado river flows through a series of deep canyons, culminating in the Grand Canyon of Arizona. This latter chasm begins near the mouth of the Little Colorado river and extends southwest 217 miles. The granite gorge section is sixty-five miles long. Here the plateau level varies from 6500 to 8000 feet above the sea. The river has carved a winding channel through the uplift more than a mile deep and from ten to thirteen miles wide. In this titantic trough are hundreds of mountains more imposing than Mount Washington, yet none of which project their peaks above the canyon's rim. The ages-old rock strata are many tinted, creating a rainbow sea of colors. There are safe trails at three points on the southern side from rim to river.

Not until the building of the Santa Fe's 'cross the continent line was the Grand Canyon made easily accessible. Today there is a branch railway from Williams, Ariz., on the main California line of the Santa Fe, to the head of Bright Angel trail, in the middle of the Grand Canyon district. Visitors now number thousands yearly where a decade ago they were counted by dozens.



Photographs by Karl Moon. **El Tovar Hotel, Grand Canyon of Arizona.**

El Tovar Hotel.

Occupying a site 7000 feet above the sea level, close to the rim of the Grand Canyon, at the railway terminus and not far from the head of Bright Angel trail, El Tovar commands a prospect without parallel in the world. A perpendicular mile from rim to river (seven miles by trail) and thirteen dizzy miles across

to the opposite canyon wall, is the story of the measuring line. The roaring Colorado below looks like a silvery thread. El Tovar is a long, low rambling edifice, built of native boulders and pine logs from far off Oregon. The width north and south is 327 feet, and from east to west is 218 feet. The hotel is from three to four stories high. Ample accommodations are provided for 250 guests. Each room is provided with telephone, electric lights, and heat with vacuum system of steam heating. Pure spring water is brought in tank cars 120 miles distant, all water for drinking

Power Plant Interior.

and ice-making is double distilled and areated. Water for other purposes is filtered through quartz filters before being pumped into the 320,000 gallon steel storage tank. The sewage is perfectly disposed with, being carried underground to Cameron septic tanks for reduction. To furnish electricity for lighting and power, making of ice, pumping of water, heating, etc., a power plant is located 250 feet from the hotel and equipped with the best machinery that money can buy.

Power Plant.

Built of native stone and concrete, the power plant is located far enough from El Tovar to be unobjectionable regarding noise, etc. The power plant

Barber Ice Machine.

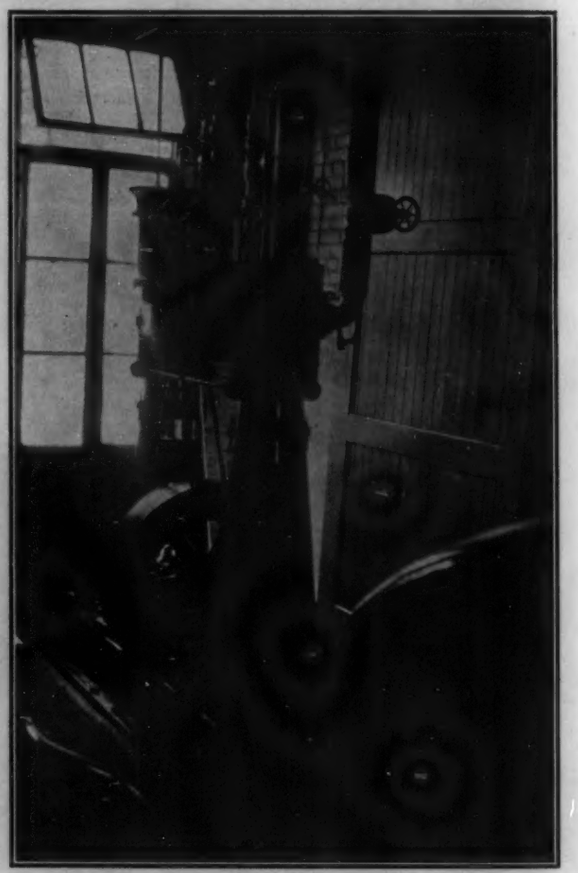
building is divided into three rooms, namely, boiler room, engine room, and feed water treating room. All wires are carried on poles to El Tovar and other company buildings. A concrete pipe tunnel connects El Tovar with the power plant, and carries the high and low pressure steam, vacuum, ammonia, hot and cold water, high pressure fire line, and air lines.

Boiler Room.

To provide steam for the entire plant two Babcock and Wilcox, cross drum type, water tube boilers, operating at 150 pounds pressure, and of 150 horsepower are installed. Feed water for the boilers is handled by two Buffalo duplex feed pumps, taking their suction from a 500 h. p. Stilwell exhaust open feed water heater and purifier, water for the heater is supplied from two 15,000 gallon treating tanks. California crude oil is used for fuel, being stored in a steel underground 20,000 gallon tank. Staples and Pfeiffer burners are used, and receive their oil supply from two 3x3x3 Snow duplex pumps. The boiler room also contains a Knowles 750 gallon per minute, underwriters fire pump which connects to 20 fire hydrants located on the grounds and two 6x8x7 Buffalo house service pumps which take their suction from an unloading cistern located near power house and discharge through a National quartz filter to main storage tank.

Engine Room.

The generating units consist of two McEwen engines direct connected to National 125 volt direct current generators of 50 and 100 k. w. The engine driving



Stevens Ten-Ton Ice Machine.

the 50 k. w. generator is simple, but the engine driving the 100 k. w. generator is a tandem compound. All bearings of engines are lubricated from gravity oiling system consisting of Cross oil filter and Marsh oil pump. Cylinder lubrication for engines is effected by double feed Phenix force feed oil pumps, all engine stuffing boxes are provided with metallic packing. A

five panel marble switchboard cares for the generators and outside circuits, six feeders ranging from 300,000 to 500,000 c. m. carry current to the different buildings. A gauge board equipped with gauges for heating system, fire system, steam, and ammonia gauges is installed adjoining the switchboard.

The Robert Gordon system of steam heating is used, each radiator about the premises is equipped with a one-half inch Gordon vacuum valve connecting to a four-inch header running to power plant where two Marsh vacuum pumps take their suction and discharge into the feed water heater. Exhaust steam is used for heating at one pound pressure and a vacuum of 15 inches is carried.

Gauge and Switch Boards.

Two ammonia compressors, one a Stevens ten ton, and the other a Barber eight ton, are located in the engine room and connect with high and low pressure lines to ice freezing tanks of four tons capacity which are located at rear of El Tovar. Brine is used also for cooling the fourteen storage boxes.

Motors are used throughout the hotel to drive laundry machinery, printing press, ice cream freezers, and all kitchen machinery. Electricity is also used in the laundry for heating mangles, etc. Outside lighting along the rim of the Canyon and around the buildings is done by 30 enclosed arc lamps, all lighting in hotel except bedrooms is by tungsten lamps of 25 and 60 watts.

NOTES ON THE VARIABLE SPEED MOTOR.

BY W. F. LAMME.

Variable speed motors are divided into two types —the direct current and alternating current. The direct current type of motor has further divisions as (a) The shunt motor, (b) The series motor, (c) The compound motor.

The Shunt Motor.

The shunt motor as usually constructed, varies its speed in one of three ways.

(a) By varying the e. m. f. applied to the armature, the e. m. f. applied to the field remaining constant.

(b) By varying the e. m. f. applied to the field, the e. m. f. applied to the armature remaining constant.

(c) By varying the area of the clearance that is by varying the air gap, the e. m. f. applied to both the armature and the field remaining constant.

The e. m. f. applied to the armature is varied by introducing a resistance or by applying different e. m. f. from the generating or distributing system, such as is furnished in the so-called 3-wire, 4-wire or 5-wire systems. However, all these systems of wiring are going out of existence except the 3-wire system, so our discussion will be confined to the armature resistance and the three wire arrangement.

Speed control by armature resistance always reduces the speed from a fixed constant speed, it has advantages as follows:

(a) The standard constant speed motor can be used.

(b) In cases where the torque decreases with the decrease of speed, it is very well fitted and is fairly economical.

The disadvantages are as follows:

(a) There must be a large and expensive resistance furnished.

(b) In cases where the torque does not decrease fairly rapidly with decrease in speed, large quantities of energy are used in the rheostat and the plan is wasteful.

(c) Unless the load is constant, the speed changes, increasing with decrease of load and vice versa.

Varying speeds secured by applying different voltages are here confined to one system, the so-called three-wire system. In this system 110 volts is first applied to the armature through resistance which is cut out, then 220 volts is applied through resistance, etc., the field always remaining on 220 volts or 110 volts. The advantages of this plan over the standard two-wire plan are as follows:

(a) A standard motor can always be used.

(b) A wide range of speeds can be obtained with a much smaller rheostat than when the 2-wire is used.

(c) The rheostat is not expensive.

(d) A constant half speed can be secured.

The disadvantages are as follows:

(a) More than one voltage is applied, this complicates the wiring to the motor.

(b) The control is complicated and in fact this is the greatest objection to the scheme.

(c) It is easy for the operator to produce trouble on his controller by careless operation.

[1]Paper read at Westinghouse Motor Dealers' Convention, San Francisco, June 14, 1909.

The above treats of speed variation on the shunt motor by varying the e. m. f. applied to the armature. Next, speed variations are produced by varying the e. m. f. applied to the field, the armature e. m. f. remaining constant. This is done nowadays usually by using commutating or interpoles and comparatively large resistance capacities in the field circuit. By this plan it is quite easy to secure a speed range of 4 to 1 and it is possible to reach 6 to 1; 3 to 1 is quite common. Speed variations by field control has advantages, as follows:

(a) The speed does not vary with variation of load but is practically constant for each notch of the field rheostat.

(b) The plan is very economical.

(c) The plan is very simple and does not give trouble.

The disadvantages are as follows:

(a) The motor is large for the output, especially in the case of wide ranges of speed.

(b) The motor has special features of construction, such as interpoles and a low field resistance.

There is still another method of varying the speed of a motor, viz., by varying the air gaps. This has an effect very much the same as field control. However, the field bobbins are always working at the same voltage applied and so low speeds are obtained without extra heat of the field bobbins, but the armature reaction is greater and so the liability to spark is greater in the case of the small air gap. Each of the above three methods of varying the speeds of a shunt motor have their special application. Sometimes best results are secured by combining two or more of the methods given.

In certain kinds of work in which the torque decreases with decrease of speed, such as driving, ventilating or blower fans, armature resistance control is the best to adopt for the reason that the armature rheostate need not be large and expensive and standard makes of motors can be used. With armature resistance control, it should be understood that the h. p. output should decrease faster than the speed otherwise the plan is not economical.

In cases where the torque is constant or increases with decrease of speed, the field control plan should be used. This plan is especially well suited for variable speed machine shop, lathe, or boring tool drive. In these cases it is desired to change the speed to some fixed values irrespective of the load, the field control motor just fits this condition.

The variable air gap type of motor is not used much here in the West. In this type of motor no field rheostat is necessary. There are two well known makes—the Stow motor, made by the Stow Manufacturing Company, and the Lincoln motor made by the Lincoln Electric Company. The Stow motor moves all its poles in and out radically by the use of a hand wheel and bevel gears. This motor looks clumsy, but it does the work well. It is an expensive motor to build. The Lincoln motor varies the air gap by pushing the armature endwise out of the field. This is done by using a screw and wheel at one end of the shaft and attached to the frame of the motor. This makes the motor look long and it is an unsightly motor. Of the two methods of air gap control, the Stow is the better for the reason that it does not throw the ends of the armature coils into the magnetic field as the Lincoln motor does.

The Series Motor.

The series motor is inherently a variable speed motor and depends upon its load to fix the speed, if the load is light the speed is high and if the load is heavy the speed is low. If the load is nothing, the speed will go very high and will endanger the motor by springing the armature coils or the commutator may burst and wreck the motor. So when the series motor is used with loads of widely varying values, there must be attendance. This motor, we know, is used almost exclusively for street car work, for crane and hoist work, elevator work, etc., where very heavy starting torque is necessary. The ordinary series motor will furnish six to eight times normal full load running torque, so we see it is decidedly fitted for the work mentioned. The series motor gets hot rapidly with heavy over-loads, because the copper of the field and armature both heat and this heat increases as the square of the load, whereas with the shunt motor, the copper of the armature only heats as the square of the load.

Compound Motor.

The compound motor is a combination of the series and the shunt motors. This motor is much used where a combination of good starting effort and of fairly constant speed is required. This motor is well fitted for driving certain kinds of machine tools, such as reversing planers, boring tools, etc., where only approximately constant speeds are needed.

Some times we find all three of the above kinds of motors used for the same work. For example, elevator work. For this work we find one manufacturer using series motors, because he thinks low starting current is the most important item in the operation of elevators. Another uses shunt motors because by this means he can return energy to the line and thus economizes on current and saves his brakes. A third uses a compound motor because by a combination of series and shunt, he thinks he saves starting current and at the same time cannot exceed a certain speed fixed by the shunt field.

There is a fourth scheme not yet tried, I believe, on elevators, that is using straight series motors and to prevent running away, employ a fly ball control attached to the motor shaft which will begin to throw resistance across the armature at a certain speed, which resistance is slowly reduced until the speed becomes steady. You note this will happen, for by the plan, the field strength is increased and the armature voltage is reduced, both tending to slow the armature speed. Further, this resistance never comes into use on ordinary or heavy loads, but only at light loads.

The Alternating Current Motor.

The alternating current variable speed motor is of two quite different types.

(1) The polyphase variable speed motor.

(2) The single phase variable speed motor.

The polyphase motor is of the induction type with a rotor specially wound that is, with regular form

wound or shaped coils connected like generator armature coils and having the terminals come out to three collector rings. Resistances are introduced between the three collector rings—the resistances usually arranged "star" and these resistances are cut out in a number of steps through a controller. The action is much the same as the direct current shunt motor having its speed controlled by armature resistance. Similar to the armature control shunt motor, the polyphase motor depends for its speed upon the load. However, there is a difference, in that, in the case of a shunt motor the torque values rise in regular increments which produce regular increases in speeds. With the polyphase motor this does not occur, but the torque values rise rapidly to a maximum then decrease. This produces an irregular increase of speed and the motor as a consequence is inclined to come up rapidly to say, one-half speed, then increase very slowly from this one-half speed to full load speed. This point is not always recognized.

When used for hoisting and other work where careful control of speed is desired, it is necessary to have an artificial method of loading such as a nicely adjusted hand or electric brake to control the speed. This control of speed cannot well be secured from the controller handle alone, as explained above and unless the artificial brake is furnished the purchaser of the outfit usually will not be satisfied with its operation.

The polyphase motor is used very extensively to operate mine hoists and to some extent, to operate cranes where direct current is not available. For the same reason it is used on elevators. In a few instances it is used on railways, usually on locomotives, of considerable size and slow speed. It is well suited to operate freight locomotives for long haul service. In a few cases it has been used in passenger and street car service, but it is not so well suited for this purpose, for three good reasons:

First—In this service stops are frequent and this type of motor is not the best to deliver heavy torque economically at start.

Second—It does not lend itself to train control.

Third—There being two high tension over-head trolleys and conductors, the over-head construction is complicated.

The single phase variable speed alternating current motor, as we have it today, is a new piece of electrical apparatus. In all its forms it uses a commutator and has a right angle correcting or commutating field.

It may be either a straight series motor, a straight transformer motor with the commutating winding in series with the armature short circuited, or with the commutating winding in series with the field and the separate armature short circuited, with the armature and commutating field short circuited separately, or with the field armature and commutating field each operated from a separate transformer tap, so that the voltage applied to each can be adjusted separately.

Most makes of single phase variable speed motors use small resistances between coils and commutator bars. This is done to prevent heavy induced currents in the coils at the time they are passing beneath the brushes. There have been attempts to dispense with these resistances, but to date little success has been attained. In this motor, the commutator is one of the limiting factors and anything that will lessen the work on the commutator will increase the output.

During the past few years this motor has been used in street car and suburban service. In this service some say the motor is a success, while others say it is a failure. This paper will not take up these different opinions further than to say that one maker attempted to use the motor without resistance leads. This attempt, of course, resulted in a failure and I believe that some of the equipments were changed afterwards to direct current. However, we should remember that this attempt does not establish the failure of this motor for railway work, it only proves that this particular form is not a success.

The single phase variable speed motor is being used in a few instances on elevators with fair success. However, a standard line has not yet been brought out for this class of service. In the Mare Island Navy Yard there are two cranes equipped with 25 h. p. 60 cycle single phase motors. These motors are reported to be quite satisfactory and are giving excellent service.

The variable speed motor, whatever the form, is coming to be a necessity. If we look about us, we note nearly all new elevators are electric drive. When a new machine shop is built the question of variable speed tool drive always comes up. Cranes almost exclusively are now electric drive and variable speed motors are frequently considered to drive variable head water pumps and variable pressure air compressors. Undoubtedly, the variable speed motor in its various forms, will be used much more extensively in the future than in the past, and it is well for us to be informed upon the types at present manufactured and carried in stock.

ELECTRICAL ENTERPRISES IN CHINA.

Consul Wilbur T. Gracey, of Tsingtau, states that a certain German firm in China has had considerable success during the past few months in securing contracts for the erection of electric-lighting plants in several cities of the Far East. This firm, whose headquarters are in Berlin, I understand, has a branch house in Shanghai, and others in Tsingtau, Hankow, Tientsin, and the other large ports of the Far East. A full supply of electric-lighting supplies, sample plants, etc., is kept at each branch house, so that intending purchasers are able to see the entire plant in working condition. This undoubtedly is the best way to secure orders for this class of goods, and the success of the method of pushing trade by personal representatives and goods on the spot is shown by this company's recent success.

An electric light plant installed in Kirin recently was put up and successfully started by this German firm. The plant consists of 2 boilers by Borsig, Tegel, Berlin, supplying steam at 150 pounds pressure to 2 high-speed compound engines built by W. H. Allen & Sons, Bedford. The engines are coupled direct to 165 kw. alternators supplying 3-phase current at 5,000 volts with a periodicity of 50, which is transformed down to 220 volts for consumers, the alternators having been manufactured by the German firm mentioned. The exciting dynamos are mounted on an extension of the crank shaft.

THE APPLICATION OF ELECTRIC MOTORS TO INDUSTRIAL SERVICE.[1]

BY E. B. PARSONS.

The application of motors to industrial service has become such a broad one and has been so interwoven with our everyday life that it deserves more than ordinary consideration. Twenty years ago an electric motor was comparatively unknown in our industrial life; in fact was a scientific toy only, whose latent possibilities were barely dreamed of. Shunt wound direct current motors in small capacities and high speeds were just then being exploited by a few small manufacturers, and their applicability to such service as machine tool drive or other special or direct connected service was scouted (if considered at all) as impossible of attainment. The series direct current motor was then used for shop service, though its characteristics were such that its application was necessarily limited to small sizes and constant, or nearly constant, load conditions. There existed in Oakland about that time a so-called commercial circuit supplying current to several motors of this type. The development of the constant potential direct current generator permitted the use of constant speed constant potential direct current motors, the first of which were of the straight shunt wound type.

The next step in development was the Sprague compound wound or differential direct current motor. With the bridging out of this type came the first real understanding of speed control of direct current motors. These motors were designed particularly for what were then considered the extreme conditions of constant speed work; one, the straight compound motor to take care of variable loads, such as hoists, industrial elevators, etc., another, the so-called differential, to take care of such work as required constant speed where great or sudden variations in load were not likely to occur, and third, ordinary constant speed work where great variations in load did not occur and very close regulation in speed was not requisite.

Up to 1895 practically all motors on the market were of the direct current type, following generally the lines laid down ten years preceding.

During the period from 1885 to 1895, the series direct current railway motor was exploited and developed to a high point of efficiency, being finally brought to a standard of 500 volts, all series wound. As our discussion appertains more to industrial than to railway service, I will not attempt to follow the development of railway motors more than to say that the lines laid down twenty years ago have been followed very closely, the series motor, whether direct current or alternating current, having demonstrated its superiority for this class of work.

In the early days of motor drive, it was only considered possible to belt from motor to driven machine, direct coupling being out of the question on account of the high speeds which were the rule in motor designs. Naturally, at that time, there was not very much call for variable speed motors; cone pulleys and other mechanical speed changing devices taking care of such cases.

With the development of the induction motor, however, there came a wonderful change over our entire industrial purview. Theretofore, it was possible to utilize motors in ordinary industrial work only within a decidedly restricted area. This was due to the impractibility of transmitting any appreciable amount of power over great distances by the use of direct current. The alternating current motor opened an apparently unlimited field for such work, bringing forth the high voltage transmission line, the rotary converter, and the motor generator set, which latter devices permitted the upbuilding of direct current power centers, practically without restriction.

Another benefit of the induction motor, which has become so common as to go unnoted, has been the upbuilding of a very large number of industrial enterprises, such as small shoe-repairing shops, machine shops, wood-working shops and a multitude of kindred enterprises which would not exist were it not for the small motor and the central station.

It should not be inferred from the foregoing that only induction motors can be, or are, used for such work, for the direct current and alternating current motors have kept pace with each other in development, each in its respective field.

This brings us to the question—what is the field for direct current motors—what for alternating current motors? If direct current, shunt, compound or series? If alternating current, constant or variable speed; squirrel cage, or wound, secondary, or series? And with these comes the very important question of method of control.

All these questions are as a rule difficult of solution, though the general characteristics, i. e., alternating or direct current are usually solved by the available current supply. Each individual case requires careful study from both an engineering and a commercial viewpoint.

First: considering direct current application, we must, to get the best result, know whether the work to be done is of an intermittent or continuous character, whether the speed required is constant or variable. The first question will generally determine whether or not the motor must be shunt or compound, and will also have great bearing on the capacity and consequent weight, dimensions and cost. Manifestly a motor applied to intermittent load service need not be of such large capacity as one designed for continuous load service, for the reason that temperature determines the size of frame, armature core and armature conductors within a wide limit.

A motor designed for 10 h. p. continuous output can, with comparatively slight and inexpensive modifications, take care of a 15 h. p. intermittent load, the only material difference in design for the latter being a larger commutator to take care of the larger current flow. During the period of maximum input this motor would tend to excessive armature temperature, but as this period is of short duration the armature has not sufficient time to reach a dangerous temperature. During the no load period the armature cools off, the resultant temperature curve being well within good operating limits. Per contra, with continuous load there is no cooling period and the motor cannot be rated as high in capacity as in the first instance.

Hoist and elevator motors, particularly the latter, are rated at their commutation limit; motors for

[1]Paper read at Westinghouse Motor Dealers' Convention, San Francisco, June 14, 1909.

continuous load service are rated at their temperature limit.

Again the character of intermittent work will determine whether a motor should be compound or shunt, or of the interpole type. Such intermittent load service as reciprocating bed planers, printing presses, etc., should be handled by compound wound motors only. The same applies to single cylinder reciprocating pump work, air and ammonia compressors, etc. This is desirable for three reasons; one, commutation; two, effect, on driven apparatus; three, effect on line conditions. A sudden change in load means a change in armature reaction and consequent change in neutral point or point of commutation, i. e., field distortion. In a shunt wound motor this is likely under extreme conditions, to reach such a dangerous point as to cause flashing over at the brushes. Compounding tends to prevent this distortion by strengthening the field, counteracting armature reaction and thus maintaining the point of commutation within reasonable limits. Another beneficial result is a tendency to slow the motor down as the load increases, this relieving the

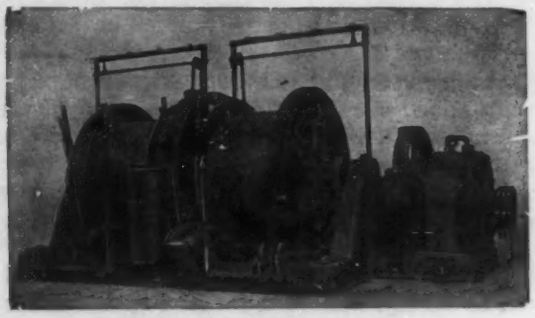
Large Motor Driven Mine Hoist.

driven apparatus of excessive shock and the circuit of such excessive current flow as would be the case if the speed were kept constant with consequent greater peak load.

Another method of taking care of such intermittent work is by the interposition or interpoles, which neutralizes to a very great degree, armature reaction. Such method of correcting commutator troubles is excellent where the work is so intermittent that commutation alone governs the size of the motor, and is well adapted to variable speed work and intermittent service. Intermittent service must not be confounded with intermittent load, however, and such motors, i. e. interval, do not give the best results where the slowing down of the motor is an advantage such an planer work, etc., for the reason that there is a tendency to maintain constant speed unless a compound interpole motor is used. This latter type seems undesirable because the functions of compounding and interpoles are, so far as commutation is concerned, so nearly alike, that the use of both implies unnecessary expense in construction. Another objection to the shunt wound interpole type for such work is that the current in the circuit rises to higher values than with the compound motor. Straight shunt wound motors should never be applied to the foregoing classes of work for they will sooner or later give trouble.

For constant load constant speed service there is no better direct current motor than the straight shunt type. For hoist service either the compound or series type should be used. Where the load is picked up and carried at a constant speed after attaining a fixed point, the compound motor must be used, the shunt winding on this type being necessary to hold the speed down to this fixed limit.

Control of these various types under various conditions requires as careful study as the motor itself. For ordinary constant speed work the no voltage release starting rheostat which is designed to give the motor full field with maximum resistance in the armature circuit at the instant of starting; the resistance being cut out step by step until full voltage is applied to the armature terminals; gives most excellent results. Where excessive load is likely to be applied to the motor, either overload release attachment on the starting rheostat or separate automatic circuit breaker should be used. Where frequent starting and stopping are required this type of starting device will not give satisfaction. The apparatus is not designed for such work. Too much time is lost in handling. A



Small Motor Driven Mine Hoist.

drum type of controller is better adapted for such work and easier handled.

These controllers are designed to start under the same conditions as the starting and stopping rheostat mentioned above or, in some cases, with more than normal field current in the shunt windings of the motor and maximum resistance in the armature circuit. With this latter type, in starting, the armature resistance is gradually cut out and the resistance later interposed in the shunt field circuit, thus weakening the field with resultant increase in speed. This method of control is particularly adapted for variable speed work, as the shunt field current is relatively small and easily handled. Fifty per cent variation in speed by shunt field control alone can be obtained with moderate increase in cost over the straight shunt wound type of motor, provided full rated output is not required at maximum speed. Under such conditions, i. e., full rated output at maximum speed, a much larger frame and consequently heavier and more costly motor must be used.

For hoist work the drum or regulating type of control is the only practical one for moderate size equipment, ease and rapidity of operation being the of prime importance. For elevator or large hoist

work, and especially for electric shovel or dredge work, or other type of control now on the market compares with the automatic or semi-automatic magnetic switch type. This type of control equipped with relays is the most flexible and safest. It can be so adjusted that in case of excessive load on the motor, the control switches will drop out one by one, interposing resistance as they do so, thus reducing the speed, even to zero, thus relieving the equipment of undue strain and when the overload condition has been overcome, again coming into action, cutting out resistance and bringing the motor up to speed. This system of control is especially adapted to distant control; for example, a shovel equipment consisting of swinging, thrust and hoist motors can all be easily handled by one man in the cab just as steam equipment is.

All standard starting and stopping rheostats now furnished by the Westinghouse Electric & Manufacturing Company are so designed that the retaining magnet winding must be connected directly across the line, i. e., the magnet winding is not in series with the shunt field of the motor, as used to be the universal practice. These coils are connected in series with a special bar of high resistance wire which is enclosed in the frame of the resistance itself, so that there is no difference in the external appearance of the rheostat. There is a distinct advantage in this method of construction, in that it makes it possible to design and manufacture a line of rheostats which will take care of a wide range of motors, that is to say, with the older practice where the magnet spool was in series with the shunt winding of the motor, the resistance and carrying capacity of this spool was necessarily proportioned to the resistance and current required for the shunt winding of the motor. This would vary in every variation in either speed or capacity of the motor, as no two motors of various speeds and capacities require exactly the same field current. On the contrary, for starting motors only, it is not essential that the armature resistance be exactly proportioned to the winding of the armature, hence, it can readily be seen that with the later design, that is, with the retaining magnet spool connected directly across the line, a greater flexibility in interchange of starting rheostats is permissible, and there is not anywhere nearly as much likelihood of trouble with the rheostat as under the old method.

Now a word of explanation and caution with reference to direct current motors and controllers. Direct current motor windings have been standardized by practically all the manufacturers at from 220 to 230 volts and 500 volts. The maximum voltage to which these motors should be subjected should not exceed 250 to 550 volts, and even at those voltages, trouble is likely to arise, due to change in magnetic conditions and brush troubles. One of the results of high voltage is a tendency to bridge the mica segments in the commutator and the only remedy appears to be grooving out the mica to a depth of approximately ⅛ inch, thus depending on air rather than mica insulation. This is directly contrary to all of our older practices, as we used to consider it most important to keep the mica even with the copper, to prevent copper or carbon dust from collecting between the segments.

Alternating Current Motors.

In general the design of alternating current motors is a much more complex problem than the design of direct current motors and the same holds to some extent with regard to their application. In designing direct current motors the principal factors are voltage, current and resistance, whereas in alternating current design, some obscure factors, i. e., hidden currents, local circuits, reactance and inductance, which directly influence the results, are involved.

For example, the starting characteristics of a constant speed induction motor can be varied greatly by the simple expedient of varying the cross section of the short circuiting rings on the end of the rotor. This will also affect the full load speed of the motor, slightly, and the line greatly. Manifestly, if the end rings were of infinite resistance (equivalent to open circuit) the motor would not start. As the resistance is decreased within certain limits, the motor would tend to more rapid acceleration, which means a greater draft on the line. In other words, reducing the resistance of end rings means that the motor will "pick up" quicker, increasing the starting current abnormally, if required to start under load.

It can be readily seen that for no load starting conditions, a motor with the least possible resistance in the secondary would be the best, whereas a sluggish motor (one which starts slowly) is best adapted to such work as driving ammonia compressors, etc., on account of the effect on the motor and driven machinery, but more particularly on the line. It should be borne in mind that in the matter of starting or speed control, the induction motor is analogous to the shunt wound direct current motor and any resistance or reactance which may be put on the secondary circuit is equivalent to resistance put in the armature circuit of the direct current motor.

There is a radical difference between direct current and alternating current motors in one particular, i. e., speed. A direct current motor can be designed for any speed, say for 10 to 3000 revolutions per minute. This is not possible with the alternating current motor, its speed characteristics being dependent on the frequency of the circuit to which it is connected, and the number of poles in which the primary winding is connected. In the application of induction motors the frequency must, therefore, be carefully taken into consideration in determining the speed of motor required.

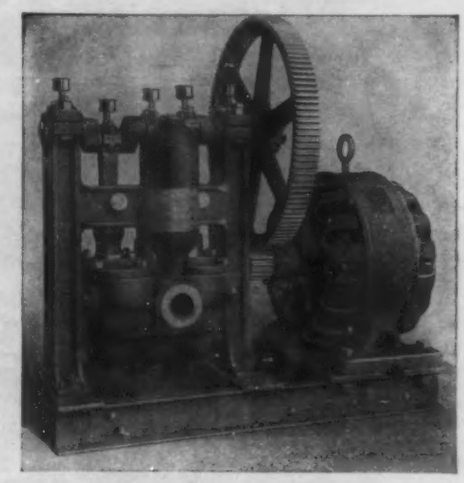
There are practically three types of induction motors, i. e., single phase, polyphase constant speed, and polyphase variable speed.

Single phase motors are not as flexible as the polyphase motors, as their starting characteristics are not as good and they are not as efficient and cannot be designed to give as good efficiency, especially in the larger sizes. They have, however, been adapted in small sizes to ordinary industrial work, with very satisfactory results. Our present type of single phase motor, which consists of a single primary running winding with separate resistance in the stator for starting which resistance, is automatically cut out as the motor approaches full speed, has given a very good account of itself. This motor has no special clutch pulley, as with our older type, the clutch being between

the rotor and the shaft on which it is mounted. No special protective devices are necessary, as the motor will start automatically if the line current is for any reason momentarily interrupted. These motors are readily adaptable to belted back geared or direct connected work. Single phase motors should not be applied indiscriminately to all kinds of service.

There are some conditions which cannot be satisfactorily met, and some that are impossible to meet with the constant speed single phase motor, and before purchasing this type, the work to be done must be carefully considered, or trouble will result. They will not give satisfaction when applied to reciprocating pump planers or press work. On circuits of very poor regulation their use is practically prohibitive for the reason that in each of the commercially successful types there is some kind of clutch mechanism which actuates the short circuiting devices to cut out the starting winding or resistance; and the operation of this mechanism depends on the speed of the motor, which in turn depends on the voltage of the circuit.

When the voltage drops below normal, the speed drops and the clutch lets go. The motor is then



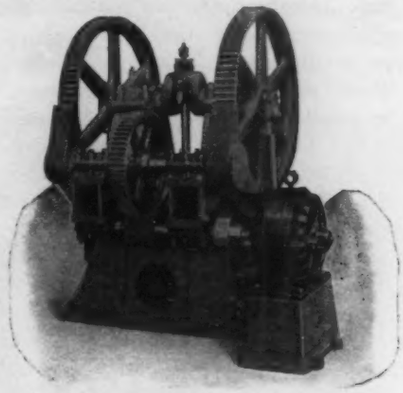
Motor Driven Aldrich Pump.

operating under starting conditions until the voltage rises, increasing the speed and throwing the clutch in. This results in either a decided variation in the speed (this variation being much greater than the variation in voltage) or a continued starting and stopping of the driven machine and will soon put the clutch out of commission, as it is not designed for any such service. Single phase motors should not be used when considerable quantities of dirt, dust or shavings are flying about, as the clutch is likely to be clogged, putting the motor out of commission.

Polyphase Motors.

Some of the most attractive features of polyphase motors are: Overload capacity; possibility of continuous service; no commutators; no brush troubles; no danger from sparking or flashing when used in the vicinity of explosives or inflammables; the minimum weight for maximum output and adaptability to almost any kind of service. Careful consideration of the conditions to be met must, however, be given, to secure the best results. Obviously, if the motor is not to start under load, one with low resistance secondary should be used. Where the motor is to start under full load or where large fly wheel capacity is to be overcome, the motor should be designed for such service. Cases often arise where a constant speed motor is required, yet the starting conditions will not permit the use of a closed circuit secondary.

Various modifications of this type have been tried, first among which was the coil wound secondary with a resistance mounted within the rotor and a mechanical short circuiting switch actuated by an external



Motor Driven Gould Triplex Pump.

lever or handle. This type proved unsatisfactory for the reason that the switch and resistance must necessarily be very compact and generally too small for the work on account of space limitations. This means poor radiation—a hot secondary—and usually switch contact troubles, which could not readily be gotten at.

The present type (which is really a modification of the variable speed type) consists of a coil wound secondary connected through slip rings and cable connections to an external resistance and controlling device proportioned for starting only. As will be readily

Motor Driven Aldrich Quintuplex Pump.

seen, it is only necessary to extend these principles of design to take care of the variable speed work, i. e., modify the secondary windings to take care of the increased current, and increase the resistance and capacity of controlling apparatus.

In addition to the variable speed type, there has been developed and put into limited use, a double speed motor. This motor consists of the ordinary closed secondary induction type with the primary windings arranged for double the number of poles required for the maximum speed: that is, an eight pole

motor arranged so that by the use of an external switch the windings can be grouped into four poles, thus doubling the speed. It is a highly efficient and very satisfactory type of motor for work where a double speed motor is required, though the expense is considerably increased on account of the necessary controlling or switching devices.

Standard induction motors are easily adapted for back geared work, the only difference between the standard and back geared types, being special end frames carrying the bearing brackets for the intermediate or back gear shaft, and special doweling of the end frames to keep the bearings in alignment. Some points in connection with the direct coupling or gearing must, however, be borne in mind, notably: Speed of gears; difficulty of "picking up" high speed or extremely heavy slow moving machinery; effect on line conditions on account of inflexibility between motor and driven machine. Gears should not be run over 3600 feet, peripheral speed, per minute, and the best results can only be secured below 1200 feet. Above 1200 feet rawhide pinions only should be used, otherwise the noise makes them prohibitive. For high speed, such as wood-working machinery, milk separators, metal saws, etc., running, say, about 3000 revolutions or 6000 feet peripheral speed per minute, motors of larger capacity than the work itself requires must be applied. This also holds good to some extent where large flywheel capacity is involved in slow speed machinery. Under any of these conditions, cases often arise where four or five times the working power is required to bring the machine up to speed necessary to do the work; in other words, the stored energy is greater than that required in the work.

The same condition confronts us in ammonia compressor work. Here the motor must start under load and, in addition, we must take case of considerable flywheel capacity, so that not only must the motor be of ample capacity, but the starting apparatus, i. e., auto-transformers and switch must be of abnormal capacity to give satisfactory results. One point in favor of the induction motor for such service is its ability to withstand very heavy overload during the "picking up" or starting period.

For crane service both the squirrel cage secondary and the wound secondary types have been used with great success. Alternating current motors are in some respects safer for such service than direct current motors, for the reason that it is possible in emergencies to hold the load with the motor instead of depending on the brake. In event of breakdown of the brake mechanism, this has in some cases been of great importance. The series alternating current motor has been also used quite successfully in crane service, though it has not been standardized for such work.

In applying variable speed alternating current motors, induction type, it must be remembered that the efficiency drops very materially as the speed drops (bearing in mind the analogy of direct current armature resistance control) and that the currents to be handled increase greatly at the same time. Another point which is sometimes of great importance is the noise caused by this type. Skewed secondaries have done much to alleviate this objection but it should not be neglected where quiet operation is essential. Speed control of this type (variable speed induction) is a very difficult matter, they being very sensitive to variations in voltage or load. Manifestly, such motors cannot be used for variable speed shop work.

In applying alternating current motors, careful consideration must be given to the voltage, especially in large capacities. Under some conditions a low voltage motor will require such large conductors to deliver power to it, as to increase the cost of the installation unreasonably; there will also appear very serious troubles with voltage and speed on account of mutual induction between conductors due to the heavy current. There appears no good reason why a 2000 to 2300 volt motor should not be used instead of 200 or 400 in sizes of 50 h. p. and upward in most instances. Standard 60 cycle motors are available in sizes of 1 to 1000 h. p. ranging in speeds from $395 to 1700 r. p. m.

In considering the purchase of such motors, it should be borne in mind that low speeds mean large frames and consequent high cost and vice-versa, and in equipping any industrial plant the question of slow speeds must be balanced against cost of larger pulleys and intermediate shafting or gearing, etc., if high speed motors ars used.

With Regard to the Actual Manufacture and Sale of Such Apparatus.

The electrical business is inherently a complex one on account of the many technical questions involved in its application and the manufacturer of such apparatus is often placed at a great disadvantage in consequence of careless or incomplete information given, or requested, by prospective purchasers. As a general proposition the purchaser almost invariably expects (and within limits very properly) successful and satisfactory operation of his motor or other apparatus, when he has completed the connection to service wires. If any trouble develops, he immediately calls on the manufacturer to "make good."

Again, if the manufacturer delays shipment of an order on account of incomplete information, the purchaser assumes that the manufacturer should have known what was wanted. If the manufacturer is not over cautious he will assume certain details which may be vital and his assumption is very likely to be wrong, with the result that the wrong type, speed, phase or voltage is delivered and has later to be exchanged. The result is dissatisfaction on the part of both; the first, because, in all probability, some important work is held up; the second, because he has attempted to do something which he has no business to do. Many of the calls to "make good" are wholly unjustified and the result is often distrust on the part of both.

As examples I will cite a few cases which have come under my observation within the past three years. A party purchased, through a dealer in wood-working machinery, a small induction motor to drive a planer. The equipment was set up and an attempt made to put the planer to work. It would not work and the manufacturer was called up by phone and request made for a man to "come and see what was the matter." A man was sent out, without instruments, and upon examination reported that there was undoubtedly something

wrong with the motor though he "wasn't quite sure whether it was a case of loose rotor bars or improper connections in the primary." Anyway the motor took enormous current, got very hot and would not bring the planer up to speed. The easiest and quickest remedy appeared to be a new motor, so a new motor was sent out and installed. Result—same thing over again. Again the same man was sent out, being cautioned to examine very carefully speed and pulley conditions. Three minutes' careful study showed that the arrangement of couplings (i. e. pulleys, belts, etc.) was such that if the motor had been of sufficient capacity to get the rig up to speed, it would have approached 10,000 revolutions per minute, would have required 50 to 60 horsepower instead of 10, and would probably have killed or maimed those handling it through the wrecking of the driven machine.

Another case—a motor was belted to a line shaft driving wood working machinery. After erecting and attempting to start the machinery, the customer telephoned that there was something wrong with the motor. Investigation by an engineer developed the

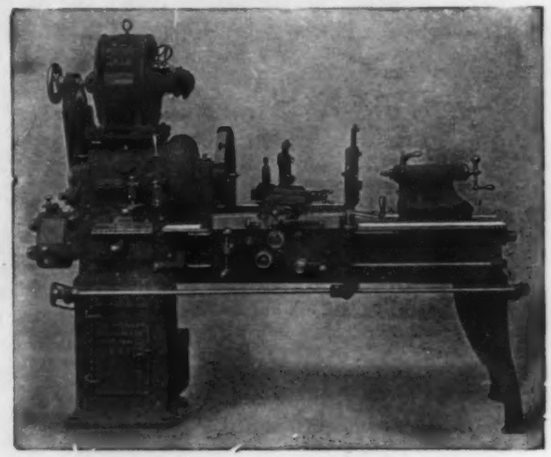
Motor Driven Hoisting Crane.

fact that the pulley propositions were such that more than double speed would have been attained had the motor been of sufficient capacity to come up to speed under the load. This job was some distance from the manufacturer's headquarters, and considerable friction was experienced in determining who would bear the expense of showing the millmen, what any mechanic should have known.

Another quite expensive case occurred in this vicinity, where a generating outfit, consisting of boilers, direct connected engines and alternating current generators and induction motors were purchased for an industrial plant. The consulting engineer figured on 1 k. w. generating capacity per h.p. motor capacity and 50 per cent overload capacity for the generator. The motors were underloaded and in nearly every instance —result—low power factor, large current output, inability to put 150 horsepower induction motors on a 100 k. w. alternating current generator. This necessitated addition of a duplicate generating set at an added cost (which had been considered unnecessary) of approximately $8,000.00 where 50 per cent added to the original rig would have saved approximately $5,000.00 and have done the same work acceptably.

Another point in regard to motor drive: Many purchasers make a practice of special pulleys on motors. This is necessary in many instances, as the motor pulley is smaller that the driven pulley and the cost of changing is, therefore, less. Great care should, however, be exercised in applying anything aside from standard motor pulleys. These standards are figured for proper belt speed and width to transmit the output of the motor, and any material change, especially if this change is in the direction of reducing the diameter, is likely to cause bearing trouble and prevent possibility of satisfactory service.

In conclusion let me offer a few suggestions with regard to ordering motors. Don't fail to give complete characteristics of motor required; if direct current;



Motor Driven Lathe.

horse power, voltage and speed, whether shunt, compound or series, and whether rails, pulley or rheostat are required; method of control, type of resistance, whether to be operated at less than full speed, and duration of such operation, belted, geared or direct coupled; if alternating current, horsepower, phase, voltage, frequency of circuit, i. e. 25, 50 or 60 cycles, etc., speed, whether with or without bedplate, pulley and auto-starter or controller, and if variable speed, all conditions of service, i. e., whether for intermittent or continuous service; if the intermittence, give the class of work to be done; time required for each run, (this is quite important) load to be handled, that is weight, speed and gearing, if for hoist service; if dredge or other light service, whether continuous operation on any notch of the controller is desired.

Liquid gas is made by compressing and freezing the gas obtained from the dry distillation of crude oil. The first plant for its commercial manufacture was established at Augsburg, Bavaria, in 1904, under the Blau process. In 1907 a plant was established at Bassensdolf, near Zurich, to use the Wolf process. After manufacture the gas is placed in steel tubes holding 20, 40, 60 and 80 pounds, which are accepted by the railways with no restrictions, as the gas is claimed to be non-poisonous and much less explosive than ordinary gas. It is used for heating, lighting, cooking and soldering and welding. Over 100 installations have been made in Switzerland, and one is being built in Paris and one in Boston.

JOURNAL OF ELECTRICITY
POWER AND GAS

PUBLISHED WEEKLY BY THE

Technical Publishing Company

E. B. STRONG, President
E. M. SCRIBNER, Vice President and General Manager
A. H. HALLORAN, Secretary and Managing Editor

DIRECTORS

R. J. DAVIS A. M. HUNT E. M. SCRIBNER C. L. COBY E. B. STRONG

604 MISSION STREET, SAN FRANCISCO.

TELEPHONE . . . . . KEARNY 918

TERMS OF SUBSCRIPTION

United States, Cuba and Mexico	per year,	$2.50
Dominion of Canada	"	3.50
Other Foreign Countries within the Postal Union	"	4.00
Single Copies, Current Month	each	.10
Single Copies, prior to Current Month	"	.25

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FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

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Rate Uniformity

The old fallacy of a uniform charge to all consumers, after having been repeatedly downed, is again being agitated as a catholicon for rate discrimination by electric power companies. The refuting facts have been told so often as to make their repetition almost monotonous, yet they are necessary to show the absurdity and inconsistency of this proposal. The scheme does not mean uniformity in methods of computing rates so as to avoid discrepancies in different cities but refers to the imposition of the same charge for all kinds of service to all consumers, whether large or small.

It ignores the fundamental principle of business which bases price on cost. It is as expensive to build an electric line to a small residence as to a large factory an equal distance from the plant. The factory uses much power at times of little demand; the residence requires little current, but takes it when the system is most heavily loaded. There can be no question as to the justice of giving a lower price to the larger consumer.

Few people realize how much apparatus is kept in reserve to meet their needs at any time of the day or night. This may be likened to keeping a stable full of idle horses, all harnessed and ready for instant work at the request of any or all the people in the town. Alternating current cannot be stored economically, but must be generated on demand. Readiness to serve this demand means an enormous increase in cost of equipment. There are some lighting systems without motor loads where the average power consumption is only one-fifth of the maximum. At the same time the cost of running lightly loaded is almost as much as at the time of heaviest load.

The expense is necessarily divided among the users. If some factory or electro-chemical works can employ the available unused power at times of light demand, it will naturally lessen the average charge to the other consumers. But to charge such a user the same proportional rate as is borne by the short-hour consumers would make the cost so prohibitive as to justify the installation of an isolated plant. Enforcement of uniform rate will, in this way defeat its own purpose, and ultimately restrict the sale of central station current to the small consumer at a high rate.

Various methods are now under discussion whereby the expense may be equally distributed. The "'readiness to serve" method employs a basic rate per kilowatt-year, which cares for the fixed cost and a low rate per kilowatt-hour which pays for current actually used. The Wright maximum demand system and the charge based on the minimum monthly guarantee are so well known as to require no explanation. All these automatic systems, singly or in combination, are being employed by various companies. There is yet room, however, for some method which is fair and equitable alike to the producer and the consumer and whose working will be easily understood by the layman, who will find no cause for suspicion of discrimination in a system applicable to all and dependent only on the amount and kind of service taken.

JOURNAL PORTRAITS

ROBERT BRUCE ELDER.

Robert Bruce Elder, well known as one of the most successful salesmen of electrical apparatus on the Pacific Coast, has received the appointment of acting manager of the San Francisco office of the Allis-Chalmers Company succeeding former manager, H. D. Scribner, whose death occurred in April of this year.

Mr. Elder is a native of Pennsylvania and in 1887 entered the electrical business on the Pacific Coast as draftsman with the Electric Development Company which held the original Edison agency for this territory. A year or so thereafter the alternating system came into prominence in the west and Mr. Elder became associated with the San Francisco office of the Westinghouse Electric & Manufacturing Company almost at the very inception of this Pacific Coast agency. About the first work undertaken by this agency was the instal-

ROBERT BRUCE ELDER,

lation of the Westinghouse system in the Baldwin Hotel at San Francisco in which Mr. Elder's first work of a practical nature was as a wireman; he later on supervised the installation of the Westinghouse plant in the Southern Pacific Company's shops at Sacramento.

The organization of the Pacific Electrical Storage Battery Company in 1891 and the interest that had arisen in the storage of electricity occasioned the next change in Mr. Elder's connections, and he became associated with the new concern in the dual capacity of salesman and superintendent of installation in connection with Mr. Frederick Reckenzaun who was also interested in the development of electrical accumulators. Some very interesting storage battery installations were made under Mr. Elder's direction, among which may be enumerated the Swain, Edenvale, Benicia, Reno, Fair and the Pleasanton plants.

Finding it impossible to carry out the original scheme of establishing a factory on the Pacific Coast, Mr. Elder in 1893 discontinued storage battery work and accepted the position of manager of the lighting department of the General Electric Company at San Francisco. He continued in this position until 1896 when he again became associated with the Westinghouse Electric & Manufacturing Company at San Francisco, which at that time was under the management of Mr. W. S. Heger. He met with unusual success as a salesman with this company; one of the many evidences of his ability resting on the fact that he carried on the negotiations and executed the contract resulting in the sale of Westinghouse apparatus exclusively for the San Gabriel Electric Company's Azusa-Los Angeles System.

In 1901 he became manager of the San Francisco office of the Wagner-Bullock Company and continued in this position until 1905 when the Allis-Chalmers Company absorbed both the Bullock Electric Manufacturing Company and the Wagner-Bullock Company of California. Simultaneously the district office of the Allis-Chalmers Company was opened at San Francisco under the management of Mr. H. D. Scribner and Mr. Elder was included in the organization as sales engineer, a position he continued to fill with success up to the time of his recent promotion to the management.

IMPORTANT ADDITION TO THE ALLIS-CHALMERS ORGANIZATION.

Edward G. Dewald, heretofore manager of the water wheel department of the Platt Iron Works Company, Dayton, O., has become identified with the hydraulic turbine department of the Allis-Chalmers Company, as special representative for the Pacific Coast, with headquarters at 599 Mission street, San Francisco. Mr. Dewald has been with the Platt Company for the past twenty years, during five of which he served as manager of its San Francisco office; and he has been identified with many of the largest hydraulic power installations in the country, including the majority of those on the Coast. Mr. Dewald's prominence in this field, coupled with the success of Allis-Chalmers Company, during recent years, in the design and sale of hydro-electric machinery, make his new connection particularly noteworthy.

CHANGES IN THE ORGANIZATION OF THE GREAT WESTERN POWER COMPANY.

The Great Western Power Company, under the direction of H. H. Sinclair, who recently took up the general management of that Company, is gradually placing in effect some important changes in both the organization and business policy.

Wm. S. Cone has been appointed Assistant General Manager and will also act as Superintendent of Construction. Mr. Cone was associated with the Edison Electric Company at Los Angeles for the past five years and also spent about a year as General Manager of the Mount Whitney Power Company.

Chester Pennoyer, who has been in charge of the construction work, has tendered his resignation, to take effect July 15th, to resume his former position as manager for the National Conduit and Cable Company on the Coast.

C. W. Hutton of the Engineering Department has been promoted to the position of Superintendent of Operation.

In order to bring the executive, engineering and operating departments into closer touch, it has been decided to move the general offices, at present located in the Crocker building, San Francisco, to Oakland. This change will be made as soon as the necessary arrangements can be completed.

Samuel L. Nicholson has been made sales manager of the Westinghouse Electric & Manufacturing Company. This is a new position in the Westinghouse organization and it is a compliment to Mr. Nicholson's business ability that he was selected to fill it. Mr. Nicholson was until recently manager of the industrial and power department of the company. His headquarters as sales manager will be in Pittsburg.

PERSONAL.

Leland S. Rosener, engineer, left last week for a short business trip to Portland.

W. F. Hall of the San Francisco office of the National Conduit & Cable Company is now in Los Angeles.

F. L. Bosqui, consulting engineer, Mills Building, who has been in Europe recently is expected home before the end of July.

Geo. J. Becker, manager Pacific Fire Extinguisher Company, is spending his vacation automobiling in Lake county and vicinity.

Bernard Bienenfield, consulting engineer, Wells-Fargo Building, San Francisco, is spending a month's vacation touring Southern California.

John R. Cole of the John R. Cole Company, San Francisco, will leave for an extended trip east during the next ten days or two weeks.

W. E. Leland, consulting engineer, Merchants' Exchange Building, San Francisco, is with the Camera Club on a trip, including Portland, Seattle and Alaska.

F. M. Broili has been made superintendent of the Comstock Pumping Association of Virginia City, Nevada, Leon M. Hall retaining his position of consulting engineer.

H. G. Levy of the Electric Manufacturing Company, 424 Third street, San Francisco, is on a trip through the East and South, arranging for agencies for their electric water heaters.

Wilbur C. Raleigh, for several years assistant city engineer, has been appointed city engineer of Tacoma, Wash., vice Frank L. Davis, deceased. He has appointed James Manley as his assistant.

R. B. Elder who has been associated with the Sales Department of the Allis-Chalmers Company for some years is now in charge of the San Francisco office of that company as acting manager.

W. S. Heger of the Allis-Chalmers Company who has spent the last two or three months on the Pacific Coast on general work for the company is now in charge of their Los Angeles office as manager.

Clem A. Copeland, well known upon the Pacific Coast through his engineering work in the past, is now associated with the engineering department of the Pacific Electric Railway Company at Los Angeles, Cal.

A. T. DeForest, Pacific Coast sales agent for American Steel & Wire Company, left on July 8 for a two weeks' business trip through Oregon and Washington. His principal stops will be made in Seattle and Portland.

Chas. F. Reuter, in charge of the electrical department of Fairbanks, Morse & Company of San Francisco, has returned from an extended Eastern trip, during which he visited the principal Eastern cities and inspected the different manufacturing plants of his company.

C. E. Groesbeck of San Diego, California, has been elected a vice-president of H. M. Byllesby & Co., with headquarters at Tacoma, Washington, in charge of their interests on the Pacific Coast and in the States of Idaho and Montana.

Anders Jordahl has left the New York office of W. I. Barstow & Co. to join their engineering staff at Portland, Oregon, which is placing the electric distribution system of the Portland Railway, Light & Power Company underground.

F. H. Poss of the Benjamin Electric Manufacturing Company and the Holophane Company's San Francisco office has returned from a trip of six weeks in the East during which he attended the annual conference and outing of the Holophane Company.

W. A. Reichert, for the past three years advertising manager for the Fort Wayne Electric Works, Fort Wayne, Ind., has resigned to accept a similar position with The Power and Illuminating Engineering Company of Alliance, Ohio. This company is a commercial organization co-operating with central stations to increase the day load on their plants.

A. T. Kalas of the Kalas & Bennett Company, San Francisco, has returned from Los Angeles, where he acted as chairman of the Hotel Committee for the Elks' Convention now being held there. He will shortly leave for a trip through Humboldt County in the interest of their large railway and logging machine supply business. He is expected to return about July 22, 1909.

Chester Pennoyer, formerly Pacific Coast manager for the National Conduit and Cable Company, and who has more recently been occupying the position of Superintendent of Construction for the Great Western Power Company, with headquarters at San Francisco, has tendered his resignation to that company and again taken up his work with the National Conduit and Cable Company. This change took place under date of July 15th.

MEETING OF WESTINGHOUSE LAMP SALESMEN.

The annual meeting of the sales force of the Westinghouse Lamp Company was held at the company's factory at Bloomfield, N. J., on June 14-17. Papers on all subjects of interest and value to the men in the field, covering fully engineering and commercial topics, were read and thoroughly discussed.

Between seventy and eighty men attended the meeting, including the salesmen of the Westinghouse Electric & Manufacturing Company, who are active in the sale of the lamp product as well as the salesmen who are specializing on incandescent lamps. Westinghouse men from even the far western offices, such as Los Angeles, San Francisco, Seattle, Salt Lake and Denver, attended the meeting. It is conceded by both the management and the salesmen attending, that this meeting was the most successful salesmen's meeting ever held by any of the Westinghouse organizations.

A banquet was tendered those in attendance by the management at the Engineers' Club, New York, on Thursday evening, June 17th, at which Mr. W. M. McFarland, third vice-president, presided. As Messrs. E. M. Herr and L. A. Osborne, first and second vice-presidents, respectively, were unable to be present, communications from them were read at the dinner. The salesmen presented Mr. Walter Cary, general manager of the company, and Mr. T. G. Whaling, assistant general manager, with handsome gold watches with appropriate inscriptions.

The salesmen of the H. W. Johns-Manville Company of New York, who handle the Westinghouse Lamp Company's product, were invited and about thirty of them attended several of the sessions.

"CURRENT LITERATURE REFERENCES" FOR 1908.

Stone & Webster, publishers, of Boston, Mass., announce that their "Current Literature References" on public utilities, etc. (construction, operation, finance), for 1908, are about ready for distribution. The edition is 500 copies, and it is desired that the gratuitous distribution of this pamphlet shall be to such libraries or persons as will be likely to find the references of decided use. The issue for 1908 is classified substantially the same as the preceding. References on conservation and water power development are more abundant than in the previous issue, but the publishers wish it to be understood that all selections are made with a view to the interest of their business, and not with a view to being a complete engineering index.

TRADE NOTES.

H. M. Byllesby & Company of Chicago, Ill., have acquired the Tacoma Gas Light property at Tacoma, Wash.

E. C. Hughes & Co., printers, engravers and bookbinders, printers of the "Journal of Electricity, Power and Gas," are now permanently located in their new building, 145-151 Minna street, near New Montgomery street, San Francisco.

C. M. Sullivan has opened an electric supply house at West Holly street, Bellingham, Wash. A feature of the new concern will be the motor boat department, under the management of J. J. Harding, an experienced motor boat repairer.

Robert E. Strahorn, President of the North Coast Railway Company, which is building a line from Spokane, Wash., to the Pacific Coast and Puget Sound, announces that the line will be electrified in the division that crosses the Cascade Mountains.

The New York Insulated Wire Company, 114 Liberty street, New York, have been obliged, because of an increased local demand for their rubber-covered wires and insulating tapes, to secure a larger New York City stockroom. The new location is at 80 Murray street.

The General Electric Company, Schnectady, N. Y., will shortly begin the erection of a five-story reinforced structure, 202 by 73 feet in dimension, and to cost over $200,000. The big building will be used exclusively for the storage of patterns and will be fireproof. The contract is to be awarded within a short time.

J. P. Clinton of Fresno, Cal., has applied for a patent on a crude oil burner which he claims is a great improvement over other burners at present on the market. One of these burners has been in use at the Santa Fe railroad shop at Fresno for nearly a year and a saving of 200 gallons of oil per day has been effected by its use.

H. B. Marshall, who has been for many years connected with the Chicago sales office of the Electric Storage Battery Company in the Marquette Building, has recently been appointed contract agent, in charge of that company's office at St. Louis, in the Wainwright Building. Taliaferro Milton, formerly contract agent of the St. Louis office, has been appointed engineer of the Chicago sales office of the Electric Storage Battery Company.

L. H. Abenheimer & Co. have opened offices in the Monadnock Building, San Francisco, Cal., for the sale of portable and industrial railways and dump cars. Mr. Abenheimer has been manager for the Koppel Company for ten years and came to the Pacific Coast several years ago, where he introduced this line. He is well known throughout the territory and well versed in all the various departments of railway material and contractors' equipment.

H. M. Hirschberg, President of the Excello Arc Lamp Company, has recently returned from a trip to Europe, in which he combined business and pleasure. Mr. Hirschberg says that the use of flaming arcs for street lighting is growing very rapidly in European cities, especially in Germany. As he visits Europe at this season every year he has had an opportunity to observe the progress of this development. He says also that the use of tungsten lamps is becoming general for all interior lighting, and that on some of the railroads in Germany small tungsten lamps have been installed. One of the new things which Mr. Hirschberg saw abroad was a new gas lamp, known as the Keith lamp, which is used in some of the German cities for street lighting. This lamp used an inverted mantle, and the gas is mechanically delivered under high pressure. He says that the light is very bright, and that the lamp is recommended as being economical.

NEW CATALOGUES.

The Specialties Department of the American Arc Lamp Company of Kalamazoo, Mich., is distributing bulletins Nos. 40 and 42 just issued, covering some interesting data relating to the four light Tungsten Shop Cluster and the Tungsten Life Saver. These bulletins include a special combination offer to assist the introduction of this device which is of particular interest to users.

The H. W. Johns-Manville Company is distributing a folder describing "Leak-No" Metallic Compound, which they claim saves things from the scrap heap. "Leak-No" is intended to quickly and permanently correct such defects in iron or steel articles as cracks, spongy spots, blow-outs and sand holes. The circular suggests numerous conditions under which this compound can be used to advantage.

Under the title "The Stamp of Approval," the Okonite Company, New York, issue an interesting leaflet designed for the instruction of the buyers of insulated wires. The well established quality of the insulated wires of this company lends to their utterances on the subject a value that is well worth taking into account by the trade. The leaflet is recommended to the reading of construction people.

The engineering department of the National Electric Lamp Association has just published, under the designation "Bulletin 9," a reprint of an address delivered before the Canadian Electrical Association by Mr. S. E. Doane on "The Conservation of Our Natural Resources Through the Use of High Efficiency Lamps." This bulletin is extremely readable, and the subjects with which it deals are of timely interest. It discusses in detail the placing of central station rates and charges on a logical basis which will allow of a more extensive use of high efficiency lamps than has heretofore been possible. Copies will be mailed without charge to anyone who will write to the Engineering Department, National Electric Lamp Association, 4411 Hough avenue, Cleveland, Ohio.

The California State Mining Bureau has recently issued maps of El Dorado and Placer counties upon which are indicated the National Forest boundaries. These maps are very useful to the miner, stockman, lumbermen and others, who are brought in contact with the Forest Service. In addition to the maps of these counties, State Mineralogist Aubury, has prepared and issued maps of Siskiyou, Shasta, Tuolumne and Sierra counties. Map of Trinity county will soon be issued and a large up-to-date State map which will show the boundaries of the National Forests, National State Park, and National Monuments. As the funds will permit, the Bureau will issue maps of all the remaining mining counties. The maps can be obtained from the Librarian of the Bureau in the Ferry Building, San Francisco, for 20 cents and 2 cents additional for postage.

The General Electric Company has recently issued Bulletin No. 4668 covering the GE 216-A railway motor, which represents the latest construction in this class of apparatus. It is of the box-frame type, equipped with commutating poles and mica insulated brush holders, and the armature shaft is removable. Among the advantages claimed for this type of construction in addition to the substantial mechanical features are: Practically sparkless commutation on even heavy overloads, reduced wear on commutator together with a marked reduction in commutator heating, increased life for the brushes and increased efficiency and free running capacity, because of lower core in commutator losses. The motors are of 50 h. p. capacity, designed for operation on 600 volt railway circuits.

The bulletin contains lists of gear ratios, and shows characteristic curves as well as dimension diagrams. There is also a carefully prepared table of schedule speeds and a comprehensive data sheet for those desiring quotations.

NEWS OF THE STATIONARY ENGINEERS.

PREAMBLE.—This Association shall at no time be used for the furtherance of strikes, or for the purpose of interfering in any way between its members and their employers in regard to wages; recognizing the identity of interests between employer and employe, and not countenancing any project or enterprise that will interfere with perfect harmony between them.

Neither shall it be used for political or religious purposes. Its meetings shall be devoted to the business of the Association, and at all times preference shall be given to the education of engineers, and to securing the enactment of engineers' license laws in order to prevent the destruction of life and property in the generation and transmission of steam as a motive power.

California.

No. 1. San Francisco. Thursday, Central Hall, 933 Market St. Pres., A. C. Arbuckle. Sec., Herman Noethig.
No. 2. Los Angeles. Friday, Eagles' Hall, 116½ E. Third St. Pres., Gabriel Allen. Fin. Sec., Harry Notthoff, 1307 Winfield St. Cor. Sec., W. T. W. Curl, 4103 Dalton Ave.
No. 3. San Francisco. Wednesday, Merchants' Exchange Bldg. Sec., David Thomas, 914 O'Farrell St.
No. 5. Santa Barbara. Geo. W. Stevens, 2417 Fletcher Ave., R. R. No. 2.
No. 6. San Jose. Wednesday. Pres., W. S. Pierson. Sec., Leal Davis, 350 N. 9th St.
No. 7. Fresno. Pres., J. F. Wagoner. Sec., F. J. Whitney, Box 8.
No. 8. Stockton. Thursday, Masonic Hall. Sec., S. Bunch, 626 E. Channel St. Pres., Jos. Gieger.

Oregon.

No. 1. Portland. Wednesday, J. D. Asher, Portland Hotel. Pres., O. H. Reed.
No. 2. Salem. A. L. Brown, Box 166.

Washington.

No. 2. Tacoma. Friday, 913½ Tacoma Ave. Pres., Geo. E. Bowman. Sec., Thos. L. Keeley, 3727 Ferdinand St., N., Whitworth Sta.
No. 3. Walla Walla. 1st and 3d Wednesday, German Hall. Pres., W. M. Quinn. Sec., O. L. Compton, Box 11.
No. 4. Spokane. Tuesday. Pres., Grant Tuttle. Sec., J. Thos. Greeley, 0601½ Cincinnati St.
No. 6. Seattle. Saturday, 1420 2d Ave. Pres., J. H. Beckman. Sec., J. C. Miller, 1600 Yesler Way.

Practical letters from engineers and news items of general interest are always welcome. Write your items regardless of style. Communications should be addressed to the Engineering Editor.

NOTES.

The twenty-fourth anniversary of Newark Association No. 3, N. A. S. E., will be held at the new Auditorium, 81 and 83 Orange street, Newark, N. J., February 12th next.

Charles C. Elsasser, who held the title of Director General during the Mechanics' Fair recently held in San Francisco under the auspices of the National Association of Stationary Engineers, has just accepted the position of City Salesman with Lally & Company, agents for the Lukenheimer line of specialties, including pipe, tubing, globe and gate valves. He is well known and his many friends among the engineering fraternity in the city and on the coast wish him every success.

SAN FRANCISCO NO. 1.

At the regular meeting of San Francisco No. 1, held at their headquarters in San Francisco on July 8th, the following business was transacted:

With a view to holding a joint meeting of California No. 1 and No. 3, a committee of three, composed of Brothers Daniel Daniels, Harry L. Gaskill and Fred E. Kuhl, was appointed to meet a like committee of No. 3 to arrange for such a meeting in the near future to receive and pass upon the final reports of the Joint State Convention Committee.

James J. McNally was initiated into the order and seven new applications for membership received; there will be no further initiations until the last meeting in this month, which will be held under date of July 29th, when all candidates who shall apply and have applied for membership will be initiated in a body.

The members received with great regret the report that Brother Herman Hendemar is still very ill and completely blind, his affliction being the result of cataracts. Brother Hendermar is one of the old school type of engineers and one of the oldest members, not only in San Francisco but in the State, and is beloved by all who know him.

SAN FRANCISCO NO. 3.

California Association No. 3 of the N. A. S. E. has recently fitted up a very complete club room in the Merchants' Exchange Building, room No. 239. The association has received a large number of applications for membership from engineers who were induced to take this action on account of the favorable impression resulting from the able manner in which the recent annual State Convention and Mechanics' Fair were conducted. Progressive engineers will do well to identify themselves with this organization as the program mapped out for the ensuing year is a progressive one and any member participating in it will be greatly benefitted. Messrs. Millner and Saville, the State Educational Committee, have outlined a line of study and discussion which it is believed will be within the grasp of all members of the association. The wants of the beginner as well as the experiences of those recognized as authorities in the science of steam and electrical engineering will receive due attention and coupled with the fact of the associations now having a most cozy and convenient club room should make membership in No. 3 a thing greatly to be desired by those engineers who are striving to keep abreast with the wonderful advancement which the engineering professions are making.

A joint committee of Associations No. 1 and No. 3 has been appointed for the purpose of arranging a reception to the joint convention committee whose work is universally conceded to be as unique as it was unusual, and the general membership is desirous of openly expressing their appreciation of the devotion which the committee exhibited toward the best interests of the N. A. S. E. The following officers were recently elected to fill the various positions in the associations for the ensuing year: Past President, Wm. P. Millner; President, W. N. Munro; Vice President, C. E. Van Metre; Recording Secretary, David Thomas; Financial Secretary, Chas. Knights; Treasurer, Chas. Dick; Conductor, D. E. Brewer; Door Keeper, John Hanna; Trustee, J. M. Lawrence.

Visiting members of the N. A. S. E. are cordially invited to attend the meetings of the association every Wednesday evening and all persons interested in mechanical subjects are most cordially invited to attend the special lectures which will be given from time to time.

TARIFF ON LIGHTING CARBONS.

Although the Senate has adopted the Smoot amendment, fixing the proposed tariff on lighting carbons at 65 cents per 100 feet, the importers in this country are inclined to believe that there will be a modification of this rate when the tariff bill gets into conference. The fact that the carbon schedule, which is such a small part of the general tariff bill, attracted enough attention to require almost five hours' discussion, shows that the matter has been to some extent studied, and is being considered by the members of Congress. Speaking of this matter, one of the largest importers of carbons in this country had this to say:

> Although it seems on the face that the importers have not been successful in their endeavor to secure a cheaper rate on lighting carbons we feel yet that we have won a distinct victory in bringing the matter to the attention of the Senators, and we feel that when the bill goes into conference a compromise will be made that will give us a better chance to do business. I have received assurances from authoritative powers in Washington that our interests are in good shape, and intimating that when the final schedule is adopted, we will be in a position to continue in business and at a profit. The main difficulty we encountered from the start was in attracting attention to a matter which was relatively so insignificant. Very few people were interested in carbons, or knew anything about them, but we have succeeded in having the matter thoroughly threshed out, and we have interested a number of prominent Senators and Representatives in the situation. We feel, therefore, that it will bear fruit when tne final consideration of the bill comes up.

INDUSTRIAL

NEW CUT-OUTS FOR ARC LIGHTING SERVICE.

A new design has been perfected in cut-outs for both series and multiple arc lighting circuits, which will add greatly to the convenience and safety of lamp trimmers. The old style of cut-out made use of a switch for breaking the circuit, whereas the improved form is automatic in action, the lamp being disconnected from the line by simply pulling the supporting rope.

Fig. 1. Series Cut-out Connected for Service.

Fig. 2. Series Cut-out Lowered to the Ground for the Making of Necessary Repairs.

Fig. 1 shows the series cut-out as connected in service. The circuit is closed by means of spring contacts, and a unique locking device holds the lamp in position. This device is very ingeniously contrived to release the lamp when it is lifted slightly from its normal position. It can then be lowered to the ground, as shown in Fig. 2, and necessary repairs can be made without the slightest danger to the linemen.

A cut-out of similar design is available for use on multiple arc lighting circuits. Both the series and multiple cut-outs are manufactured by the General Electric Company.

WESTERN ELECTRIC REPORT FOR FIRST HALF OF FISCAL YEAR.

While the first half of the fiscal year of the Western Electric Company, ended with May, shows an improvement in business and an increase in sales volume far ahead of expectations six months ago, the most satisfactory element of the situation and the one upon which the officers are felicitating themselves most, is the fact that the company is making money under present market conditions. An officer says:

"May 31st ended the first half of our fiscal year. Our business is running at the rate of approximately $46,000,000. This would compare with $33,000,000 for the fiscal year of 1908 and $53,000,000 for the fiscal year 1907 and the percentage relation is an improvement of 40 per cent in the first case, and at the rate of 87 per cent of the 1907 record. The present business outlook seems to us good but without anything to lead us to expect an unusual growth in our business. A sure and steady increase, however, may be confidently looked forward to if business conditions continue along the lines they are doing at present.

Some lines of our business, such as our sales to the telephone companies outside of the Bell sytem (which have been a feature of our business for only the last year and a half), have shown a very satisfactory growth, while our business in machinery has, notwithstanding the depression, grown steadily throughout the last few years and is now at the highest point in the history of the company. Business is running more than ever before to moderate-sized motors and generators, largely used for industrial plants, which shows a healthy activity, and the prices and margins of profit at which they are being sold were never so good."

The increase in the machinery sales for the half-year was 40 per cent over the same period a year ago and closely reflects the improvement in industrial conditions since a large part of the machinery orders were for additions and improvements.

Gross business for the first quarter of the fiscal year ran at the rate of $42,000,000 per annum and for the last quarter at the rate of nearly $50,000,000 for the year, an increase of about 19 per cent. While the business for May is usually ahead of the business of the preceding month, the increase of May, 1909, over May, 1908, showed approximately 60 per cent. The month of April, 1909, showed an improvement equivalent to 50 per cent over the April, 1908, and if the ratio of improvement of the last two months continues the company will easily attain a $50,000,000 year.

The business with the farmers in the agricultural states has been satisfactory and with the good crop prospects that exist at present there is every prospect that the development along this line will continue.

The volume of the company's orders for the six months increased about 30 per cent over the same period in 1908 and the average value per order increased approximately 10 per cent. In certain lines the volume of orders increased more than 50 per cent.

The export business for the most part has not felt the impetus of the improvement in this country, running only slightly ahead of last year. The European business from the company's foreign plants, however, gained 30 per cent over a year ago and was 12 per cent greater than 1907, which previously held the high record. This remarkable gain is due to the fact that the company's trade with foreign countries is not so much dependent upon industrial conditions as the condition of the foreign governments' exchequers. A greater part of the export business is done with South American countries, which felt the effects of the panic heavily. Coincident with the betterment of conditions in this country the Dominion of Canada reports improvement in trade.

The Western Electric is putting more copper into consumption at present than for a long time. As is the established policy of the company, however, the metal is purchased only for requirements that can be clearly foreseen.—Wall Street Journal, July 2, 1909.

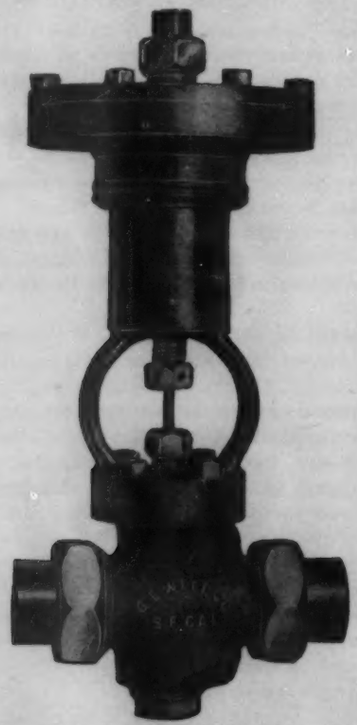
The Keystone Metal Brazing Company of Los Angeles are arranging to move from their present headquarters at 1214 North Main street, to 715 North Main street, where increased floor space will offer better facilities for handling their largely increased business.

RELIABLE PUMP GOVERNOR.

The G. E. Witt Company of San Francisco are calling attention to the good features of their patented Reliable Pump Governor which has been adopted by the United States Navy, the Southern Pacific Company, the California Northwestern Railroad and the Western Pacific Railroad for use with sanitary, oil and fire pumps.

The manufacturers make the following claims for this governor:

The movement of the valve is governed by a diaphram controlled by compensating spring. It is positive in action and absolutely automatic, insuring uniform delivery pressure, regardless of variation in the boiler pressure. The valve is a double seated regrinding balance valve. The valve stem



Reliable Pump Governor Manufactured by the G. E. Witt Company.

can be adjusted by turning the head containing the diaphram to right or left. The desired pressure is obtained by adjusting set screw under spring. All connections are fitted with extra heavy ground joint unions. It can also be used for a pressure reducing valve having a positive cut off. This governor has no blind stuffing boxes and will not blow through from one chamber to another as the steam and water ends are entirely separate. Guaranteed absolutely reliable. For design, workmanship and regulation it has no peer. Its use will prolong the life of the pump and save fuel.

Catalogue and price list on Pump Governors, Reducing Valves and Oil Burning Appliances will be forwarded on application by the manufacturers.

A CHLORIDE ACCUMULATOR INSTALLATION.

The generating equipment of the town lighting plant at Eddyville, Iowa, consists of a 55 k. w., 220 volt D. C. generator belted to a Corliss engine. During the year 1908 the load during peak hours reached, and in fact exceeded, the rated equipment of this set, thus necessitating increased capacity. It was felt that if a 24-hour service could be maintained, the number of customers could be materially increased, the 24-hour service being an additional inducement to users of electric light and power. An attempt had been made to run a day circuit by operating their generating unit, but the expense of this method proved prohibitive.

A battery installation was, therefore, considered, and placed in service in January, 1909, for the purpose of providing 24-hour service, and supplying the excess peak load. This battery consisted of 130 cells of "Chloride Accumulator," manufactured by the Electric Storage Battery Company of Philadelphia, with a capacity of 25 amperes for eight hours. It was found that the battery could be charged during the normal run of the steam generating plant, and would then have sufficient capacity to supply the demands for service after 11 p. m., when the plant was shut down. On occasions when the load during the peak is in excess of the generator capacity the battery is also used to assist the generator. At infrequent intervals, a comparatively heavy demand is made on the plant by the theatre, lodge halls and churches, and on occasions the battery is available for supplying the excess demand.

Since the installation of this equipment a material increase has been noted in the number of customers, and since this is a municipal plant it is felt that the battery has been of manifold advantage as it has not only increased the receipts but greatly improved the service.

PORTABLE HOUSES POPULAR.

The growth of the business of manufacturing portable houses from an insignificant experimental proposition to a business involving thousands of dollars capital, is one of the industrial surprises of the last decade.

It is now possible to obtain neat and practical structures at short notice, which can be easily erected in from three or four hours to a day, according to the size of the house. These buildings are made in Los Angeles, shipped to the destination in sections, and erected complete, with much less effort and for less money than if built permanently on the spot, and in many cases the fact that they are portable is an advantage, as the location of the house may be changed as often as desired.

These houses are manufactured by H. J. Brainerd, 507 Chamber of Commerce Building, Los Angeles, who has in-

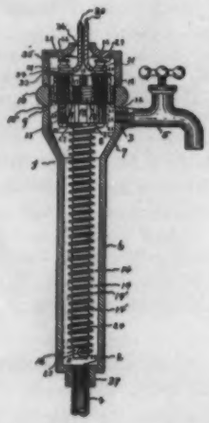
Portable Automobile Garage.

stalled at that point a modern manufacturing plant completely equipped for extensive operations for the sole purpose of manufacturing all kinds of buildings for the city, country, seashore, mining camps, mountains and oil fields, under the "Ducker" patents; the material used in their manufacture is thoroughly seasoned redwood and Oregon pine and the manufacturer claims that they have stood the test of time in every climate on earth.

Our illustration shows one of the many types of buildings which Mr. Brainerd turns out, a portable automobile garage. Buildings of this character are particularly adapted to the climate on the Pacific Coast and should appeal particularly to those engaged in power construction, as its convenience in construction camps will be readily recognized.

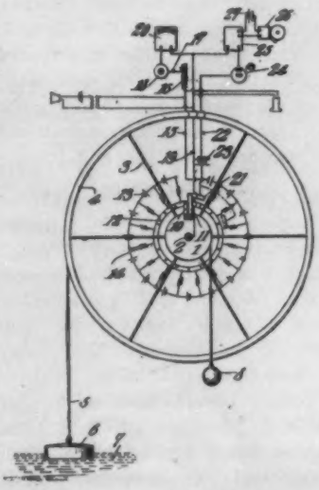
PATENTS

926,185. Electric Water-Heater. William E. Hayes, Omaha, Nebraska. In a water heater, the combination with a receptacle having an intake and an exit way, and a screw-plug for closing one end of the receptacle, of a non-conducting supporting core within the receptacle, said core having me-



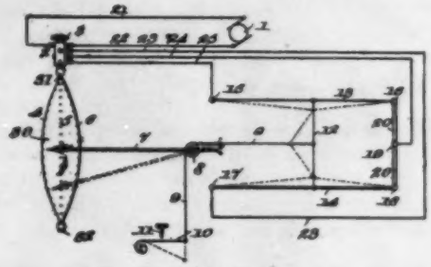
tallic conductors seated thereon and traversing the screw-plug; a resistance coil mounted upon said non-conducting supporting core and having terminals in communication with said metallic conductors; exterior conducting wires in communication with the metallic conductors; means for longitudinally adjusting the metallic conductors for causing a pressure of the non-conducting core upon the screw-plug.

926251. Hydrostatic Indicator. George Harding, Coeur d'Alene, Idaho. A fluid level indicator comprising a rotatable member, a float and connections therefrom to the rotatable member for moving said member in one direction, a counter-weight and connections therefrom to the rotatable member for moving the latter in the other direction, a circular series of contact plates, sources of current connected together in series, connections between each current source and a respective



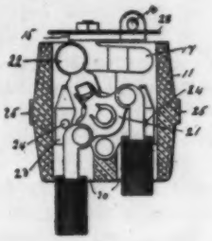
one of the contact plates, a resistance element for preventing short circuiting included in each connection between the current sources and the respective contact plates, an indicator responsive to variations in current, an electric circuit including the indicator, means under the control of the rotatable member for coupling the current sources to said circuit, another charged circuit, an alarm under the control of the last named circuit, a contact terminal for said last named circuit, and a circuit closer carried by the rotatable member and adapted to engage the last named contact terminal to close the last named circuit.

926,536. Thermo-Expansion Meter. Clifford D. Babcock, New York, assignor to The United Wireless Telegraph Company, New York, N. Y. In a hot wire current meter, the combination of a plurality of expansion elements; a switch adapted



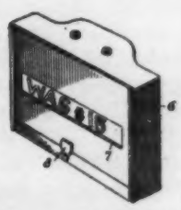
in one position to close a circuit through one of said elements, and in another position to close a circuit through another of said elements; a pointer; and a scale for each of said circuits with which said pointer coacts, substantially as described.

926,622. Pendent Electric Switch. George B. Thomas, Bridgeport, Conn., assignor to Perkins Electric Switch Manufacturing Company, Bridgeport, Conn. A push button pendent switch, comprising an outer casing and an insulating cup-shaped body open at the top for the insertion of the switch



mechanism, in combination with binding posts and spring clips at the top thereof, switch mechanism inclosed in the body and a sheet of insulation separating the binding posts from the switch mechanism.

926,393. Electrically-Operated Price-Card. Percy L. Dirking, Spokane, Wash., assignor of one-sixth to Julian D. Miner and one-sixth to Joseph A. Pelkey, Spokane, Wash. The combination of a casing, a magnetic member mounted therein, a platform provided with means whereby it may be lifted by



said magnetic member, a card provided with a plurality of legends, means for supporting said card upon said platform so that said legends are exposed successively to view as said platform is moved, and means for automatically illuminating said legends at the instant only when they occupy certain predetermined positions.

NEWS NOTES

FINANCIAL.

SANTA BARBARA, CAL.—The City Clerk will receive sealed bids up to July 22d for the purchase of any or all of the $40,000 water-works extension bonds.

ODESSA, WASH.—The election carried in favor of the issuance of bonds in the sum of $16,000 to make improvements to the water system and to validate the indebtedness of the town.

PORTALES, N. M.—The City Council has passed Ordinance 20 providing for the issuance of negotiable coupon bonds of this city, to the amount of $50,000 for the construction of a system of water works.

EL CENTRO, CAL.—Because of technicalities citizens of El Centro will not vote on the proposition to issue bonds in the sum of $75,000 for a municipal water system until after the completion and acceptance of the city's tax roll for the ensuing year, which will not be until after August 15th.

SIERRA MADRE, CAL.—It appears that the issue of gas bonds may yet be declared legal and the city in a short time start its plant. City Attorney Madden does not except the bond buyers' attorneys' opinion as final. He has found several flaws in the opinion which may be set aside, and thereby save the city considerable time. The last Legislature passed what is known as a curative act, which it is thought may cover this question.

SAN FRANCISCO, CAL.—The United Railroads has submitted to the Supervisors a statement of the operations of the various roads under its control for the year 1908, which are conducted under franchises requiring the payment of yearly percentages to the city. It shows that the total receipts, on which the city gets 2 per cent, were $1,558,215.17. In this class are the Turk and Eddy streets line, which brought in $260,655.48; the Fillmore-Street line, $407,678.37; the Ellis-Street and ocean line, $110,752.76, and the Eighth and Eighteenth-Street lines, $114,569.56. The roads on which 3 per cent is collected were the Masonic-Avenue, San Bruno, Bosworth and Railroad Avenue lines, yielding $51,401.52. The only road paying 4 per cent on the receipts is the Sixth and Sansome-Street lines, which yielded $5,674.55. From these figures the company's officials estimate that there is due to the city $32,933.98.

SAN FRANCISCO, CAL.—William P. Bonbright & Co., London, New York and Colorado Springs, Colo., are offering at 98½ and interest, yielding about 6.12 per cent $200,000 debenture mortgage 6 per cent gold bonds of the Pacific Gas & Electric Company, dated December 15, 1907, and due December 15, 1937. Interest payable January and December 15th; Trust Company of America, trustee; denominations, $1000 or multiples thereof; authorized, $4,000,000; outstanding, $3,651,000. A circular says: "A sinking fund has been established for the redemption of these bonds as follows:

On March 1, 1918, and yearly thereafter, to and including 1927, $125,000; on March 1, 1928, and yearly thereafter, up to and including 1937, $250,000. Bonds shall be drawn by lot at par and accrued interest, to absorb all of these sinking fund payments as and when they are made. These bonds are amply secured by a mortgage on all the property of the company, which has a physical valuation of $90,000,000, being $33,818,000 in excess of the entire funded debt. After deducting all of the fixed charges from the net earnings of the past year, the balance available is over eight times the interest required on this entire authorized issue."

INCORPORATIONS.

LOS ANGELES, CAL.—Canadian Queen Oil Company, capital stock $500,000, by W. Moore, S. W. Beatty, A. G. Nichols, H. B. Guthrey and J. R. Riggins.

LAS VEGAS, NEW MEX.—Giant Oil and Gas Company of Roswell, capital stock $500,000, by H. J. Haggerman, W. C. Reid and Edgar Salfee, all of Roswell.

LOS ANGELES, CAL.—Hawthorne Electric Water Company, capital stock $50,000, by H. D. Lombard, B. L. Harding, F. V. Gentry, C. F. Tansey and A. W. Allen.

SAN FRANCISCO, CAL.—Gavette Oil Company, application of the H. B. Hayden for order to withdraw original articles from Monterey County; place of business San Francisco.

SAN FRANCISCO, CAL.—Ventura Oil Development Company, capital stock $3,000,000, by W. N. Howes, C. B. Barnard, Pelz James, D. D. Wannamaker and F. P. Bonham, 5 shares each.

FRESNO, CAL.—Los Angeles-Coalinga Oil Syndicate, capital stock $60,000, by W. C. Elderton, W. W. Fedder, Warren Gillelen, J. U. Zallee, Jos. Rettigstein, Felix Levy and H. D. Vandeever, all of Los Angeles.

TRANSMISSION.

LOS ANGELES, CAL.—The Los Angeles Railroad Company has just completed the installation of the first unit of its sub-station at the corner of Sixteenth and San Pedro, Los Angeles.

SANTA ANA, CAL.—A franchise to erect a line of poles and wires up Santa Ana canyon to the Riverside boundary line for the transmission of electrical energy, has been sold to the Edison Company for $100. That corporation was the only bidder.

SAN FRANCISCO, CAL.—According to reports from New York Eastern capitalists have negotiated for the purchase of all the holdings, rights and titles of the Central Counties Power Company, the Central Counties Land Company and the Yolo Consolidated Water Company in the Clear Lake region and within a short time work will be commenced on one of the largest power plants in the West. All preliminary arrangements have been disposed of and it only remains now to take actual possession and initiate the project which involves the expenditure of between $7,500,000 and $10,000,000.

GOLDFIELD, NEV.—With the completion of the storage reservoir that is now being erected by the Nevada-California Power Company on the south fork of Bishop Creek, and which will have a total capacity of 600,000,000 cubic feet of water, it is expected that Goldfield and Southern Nevada will be immune from loss of light and power. Delos A. Chappell, general manager of the company, has returned from Bishop, where he inspected the plant. "The floods from the melting snows of the winter always have been a problem we have had to contend with," said Mr. Chappell, "but with the building of the new reservoir there will be no likelihood of such an occurrence as last week repeating itself. With its completion, it will be large enough to hold in check all of the flood waters liable to come from the mountains." It is expected that the dam will be completed in several months, and when this is accomplished the accumulated snows of the winter will not be sufficient to over-tax its capacity, and when once placed in operation it will insure to Goldfield and Southern Nevada steady supply of electricity.

TELEPHONE AND TELEGRAPH.

PETALUMA, CAL.—The ranchers living in the vicinity of Lakeville have decided to install a rural telephone system in their neighborhood.

SAN LUIS OBISPO.—A wireless station has been erected here and will be opened for public business at once. The local station will relay messages between San Francisco and Los Angeles, and will also report vessels equipped with wireless apparatus as they pass up and down the coast.

SAN JOSE, CAL.—Preliminary tests have been made of the site recently purchased by the telephone company for the erection of a modern building on South Market street, and it is expected that work soon will begin on the new structure. The plans for the building are being prepared in the San Francisco offices of the company and have not been made known here. The new building, which will be located next to St. Joseph's Church, will be four stories in height, although a foundation will be laid for a building of seven stories, the three upper floors to be added as the city grows and the business of the company increases. It is not improbable, however, that the officials will draw plans for the seven stories immediately. Every office in the building will be occupied by the telephone company, the officials of which are now scattered about the city.

ILLUMINATION.

EUGENE, ORE.—Sealed bids are being received for furnishing switchboards, transformers, oil switches, etc., for the hydro-electric power plant on the McKenzie river.

SELMA, CAL.—William Shafer, an expert gas man, is in Selma inspecting the local gas facilities with a view to providing something more suitable to the needs of the place.

SAN FRANCISCO, CAL.—A gas explosion at the North Beach plant of the Metropolitan Light and Power Company on July 10th did some little damage to the plant and seriously injured one employee.

MONROVIA, CAL.—A petition is being circulated in Monrovia asking the City Council to call a bond election to decide whether or not $50,000 shall be raised for the purpose of installing a municipal gas plant.

SEATTLE, WASH.—Leslie M. Adams and William Muljoland have applied to the county commissioners for a franchise for the construction and maintenance of an electric light and power system in this county.

RIVERSIDE, CAL.—The San Bernardino Valley Gas Company, a new corporation, recently took over the business of the Home Gas & Electric Company of Riverside. The new company's office is 807-8 Union Trust Building.

SAN JOSE, CAL.—Harry J. Edwards, one of the pioneer gas men of California, died here July 10th. He was manager of the United Gas & Electric Company and had for thirty years been connected with the lighting plant in this city.

REDONDO, CAL.—The Trustees have ordered a new lighting system for the business section along Pacific avenue and opposite the amusement center. It calls for installing of bower incandescent lights formed by strings woven across the street. There will be about 2000 lights used.

TACOMA, WASH.—The Superior Court has decided the suit of the city against the Nisqually Power Company and Cascade Public Service corporation to condemn the water and land for the municipal power plant on the Nisqually river, the court holding the city had superior rights and was entitled to the property. This will enable the city to go ahead with its project for the erection of the 20,000 horsepower electric power plant for which plans are being made by Engineer Frank Kelsey.

FRESNO, CAL.—The San Joaquin Light & Power Company at Fresno, California, is employing a large force of men enlarging the reservoir and ditch system in Madera county. The company is preparing to increase its power supply by 17,000 horsepower. The capacity of the pumping plant will be largely increased, and new generators and other machinery will be installed.

REDLANDS, CAL.—John M. Gardner and R. H. Duncan, president and secretary, respectively, of the San Bernardino County Gas Company, are here looking over the books and familiarizing themselves to some extent with the financial affairs of the company here. It is the intention of the company to proceed to lay a pipe between Redlands and Colton. This will be a pipe that will withstand pressure and the Redlands plant will furnish the gas for Colton while the plant there is out of commission—being torn down to make room for the new and enlarged machinery which will be put in. Then when the plant is completed, the same pipe will be utilized for sending gas from Colton to Redlands. This pipe will be ten miles in length.

SAN BERNARDINO, CAL.—Deeds transferring the plants of the Redlands Home Gas Company and the Colton Gas Company to the San Berdardino Valley Gas Company have been filed, the properties completely inventoried by representatives of buyer and seller, and possession given, thus marking the final step in the big merger of gas plants which has been under way in this valley for several months. The largest single item of the merger thus far in evidence, the plant of the Home Gas Company of this city, was to have been also transferred at the first of the month, but at a meeting of the directors held last week, an extension until August 1st was granted. However, that will not be necessary, for with the Redlands and Colton properties already transferred, the local plant is next on the list, and the work of completing the details will be taken up early in the coming week, and Manager Z. T. Bell says that this might be completed by July 15th, although even in that case the formal transfer is hardly to be looked for before the first of the coming month.

TRANSPORTATION.

LOS ANGELES, CAL.—The Los Angeles Railway Company has begun construction of a line from Stephenson avenue to Los Angeles river at Seventh street.

SALINAS, CAL.—An ordinance has been passed granting H. R. O'Bryan a franchise to construct and operate a street railroad in the county of Monterey, Cal.

LOS ANGELES, CAL.—The council has directed the publication of a notice of sale of a street railway franchise applied for by the Pacific Electric Company on Sixth street between Olive and Figueroa.

LOS ANGELES, CAL.—Application has been filed with the city clerk for a franchise granting right to construct and for a period of 21 years to operate a double track electric railroad upon certain public streets in this city. Sealed bids will be received.

ELLENSBURG, WASH.—Application for a 50-year franchise to operate an electric railway on the principal business streets of Ellensburg is made before the City Council. A. S. Randall, an official representative of Frank S. Farquhar of Tacoma signed the application.

NILES, WASH.—The Big Ben Transit Company has completed a survey of the river and a site for a dam under direction of Engineer L. F. McCoy. A 60 foot dam will be built. The company proposes to build an electric railway from Spokane to the Columbia river steamboat landing above the mouth of Spokane river. The Narrows will be used as a power site.

LOS ANGELES, CAL.—The Los Angeles Pacific Railroad Company has just completed the installation of a 600 kilowatt generating set at the Bush street sub-station. Work on standardizing a track in the Hollywood and Coal Grove divisions, the company's only remaining narrow gauge lines, will be started as soon as the Harriman tunnel is completed.

SACRAMENTO, CAL.—The contract for building the line of the Central California Traction Company from 31st and X streets, in this city to the State Agricultural Park on the upper Stockton road, a distance of about two miles has been let, and grading will begin at once. The company already has, in conjunction with the Northern Electric, constructed the line down X street from Thirty-first to Front. The steel for the road has been ordered, and is expected to arrive by the time the grading is completed. The officials of the road say they will have its part of it completed by the latter part of August.

BERKELEY, CAL.—At the last meeting of the trustees of Ocean View, a franchise was granted to the Southern Pacific Company for the construction of an electric railroad, that company being the only bidder. Five hundred dollars was the price offered. Work upon the new line must begin in four months and must be completed in three years. The granting of the franchise affords the Southern Pacific Company the opportunity to complete the north end of its loop in the new electrolized gridiron system. There are now three lines to run through Berkeley, one on Shattuck avenue, on on California street and another on Ninth street. All of these lines extend to Ocean View and the franchise which was just granted will permit them to enter at one end of the town and to leave at the other via Shattuck avenue and California street. This will perfect the so-called shuttle service which will be a part of the electrolized system.

OAKLAND, CAL.—The first steps in the actual work of electricizing the Oakland lines of the Southern Pacific Coast Railway Company and the extension of the Webster street narrow gauge line into the Key Route territory by the way of Franklin and Twentieth streets, was taken in the application before the City Council for both projects. The petition asks for a 50-year franchise to extend the Webster street line from its present terminus at what is known as the Fourteenth street depot, north on Franklin street to 20th street and thence through the block bounded by Twentieth and Twenty-first streets northwestward to San Pablo avenue. The application for the electrizing of the Webster street line asks permission to change its motive power from steam, as used at present, to electricity, and the use and occupation of the street in the change. If the franchises are granted, it is understood that work will be started at once, but for the present both matters were given committee references.

AUBURN, CAL.—Supervisor John W. McFadden has presented the application of W. S. Fletcher and associates of Pasadena for a franchise to build an electric railroad between Colfax and the village of Bath, one mile east of Forest Hill. In his application for a franchise Fletcher agrees, in case his application be granted, to commence work within 30 days and to complete the road within four months from the date that the franchise is granted. The proposed line is to be narrow gauge, will be something like 16 miles in length, and will practically run over the present stage road between Colfax and Forest Hill, with a few cut-offs at convenient points. W. S. Fletcher, the Pasadena capitalist, who is asking for the above franchise, has already put a large amount of capital in various mines on the Forest Hill and Michigan Divides. He is now establishing a 2000 horsepower electric plant at the Home Ticket mine at Last Chance, 14 miles above Michigan Bluff. The proposed electric road is intended to carry both passengers and freight, and the estimated cost of it is in the neighborhood of $250,000.

SACRAMENTO, CAL.—Work on the extension of the Third and P streets car line of the Sacramento Electric, Gas & Railway Company connecting the P street and T street lines by a cross line down Third and the cross line from Fifteenth and P streets, down Fifteenth to T, has been commenced. The company has made application to the city street department for permission to construct a double track on Fifteenth street, from P to T, and a single track on Third street, from P to T. It was announced that work on the two cross lines will begin immediately and be rushed to completion as quickly as possible. The company already has franchises for the short lines, and the necessary permission from the city street department will be given. The cross line on Fifteenth, from P street to T will connect the P street and Twenty-first street lines with the T street line and the extension of the Third street line to T will connect the Third and P street line with the new line on T street. A single track extends down T street from Seventh to Front, and it is this line which will be joined by the Third street extension for which application has been made. When these two extensions are built T street will have been tapped by five lines running north and south, as follows: At Third and Seventh, Fifteenth, Twenty-first and Twenty-eighth. This will make a sort of checker-board out of the southern part of the city, giving that section more street railways than any other in Sacramento.

WATERWORKS.

AZUSA, CAL.—Judge Charles Silent has provided for laying of 1200 feet of pipe on Azusa avenue to irrigate palms growing on each side.

AZUSA, CAL.—The City Council will receive sealed bids up to July 19th for furnishing the city 1500 feet of 2-inch standard wrought screw pipe.

VICTORIA, B. C.—Sealed tenders, endorsed and addressed to W. W. Northcott, purchasing agent, will be received up to August 16 at 4 p. m. for supplying cast iron water pipe, pig lead and gate valves.

PORTLAND, ORE.—The City Council has passed resolutions providing for water mains in Overton street at a cost of $878.58; East Tenth street at a cost of $3997.79; East Ninth, $4154.07; Sixth, $1124.12, and Eighth street, $3702.97.

IMPERIAL, CAL.—Imperial City Trustees have engaged A. L. Sonderegger of Los Angeles as consulting engineer for the municipal water system. It is proposed to install one which will filter water before it is forced into distributing mains.

SAN BERNARDINO, CAL.—The Delta Water Company has applied to the Board of Supervisors for a franchise for a period of 50 years to lay and maintain a pipe line eighteen inches in diameter along E street. Sealed bids will be received by the Supervisors up to August 3d for the required franchise.

SAN RAFAEL, CAL.—Preliminary to establishing a general water supply under the recent Legislature act, all the municipalities in Marin County will be asked to send delegates to a meeting to be held in San Rafael on July 28th, when ways and means will be considered. This action is the outgrowth of the application of the Marin County Water & Power Company for a restraining order, to prevent three trustees from enforcing the rate ordinance which it adopted, to take effect on July 1st.